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VOL II

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(NASA-CR-136741-Vol-2) ATTITUDE CONTROL
PROPULSION COMPONENTS, VOLUME 2 (IIT
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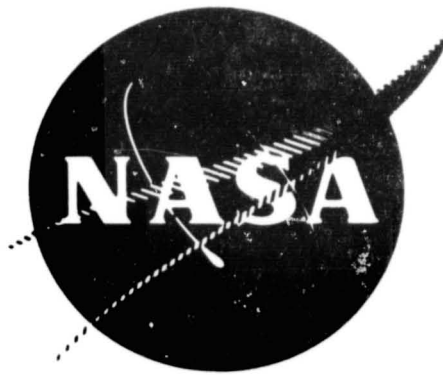
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JET PROPULSION LABORATORY
CALIFORNIA INSTITUTE OF TECHNOLOGY
PASADENA, CALIFORNIA



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VOL. II

ATTITUDE CONTROL PROPULSION COMPONENTS

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VOLUME II

NOVEMBER 1974

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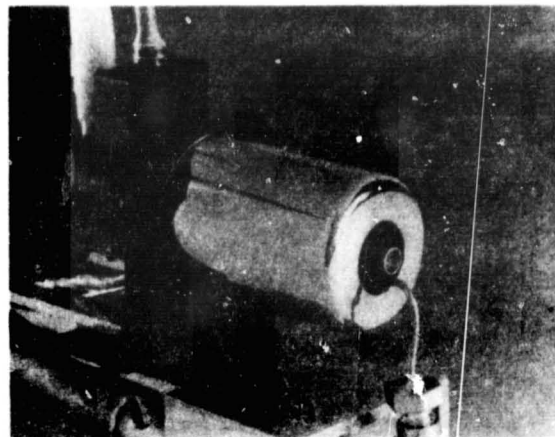
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ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE

MANUFACTURER Rocket Research Corporation

PART NUMBER MR-74A



VALVE MANUFACTURER.....	<u>Parker Hannifin</u>	PART NUMBER	<u>570060</u>
HEATER MANUFACTURER.....	<u>Clayborne Lab.</u>	PART NUMBER	<u> </u>
	<u>Chamber Heater</u>		
SENSOR MANUFACTURERS.....	<u>ARI Ind.</u>		
	<u>Chamber Thermocouple</u>		
TEMPERATURE TRANSDUCER	<u> </u>	PART NUMBER	<u> </u>
PRESSURE TRANSDUCER	<u> </u>	PART NUMBER	<u> </u>
PROGRAM.....	<u>ATS F&G</u>		
CONTRACTING AGENCY	<u>NASA</u>		
PRIME CONTRACTOR	<u>Fairchild</u>		
STATUS			
QUALIFIED	<u>Yes</u>		
FLOWN	<u>Yes</u>		
LAUNCH VEHICLE	<u>Titan 111 C</u>		
AVAILABILITY	<u> </u>		
COST/PROCUREMENT INFORMATION...	<u>Upon Request</u>		
	<u> </u>		
	<u> </u>		
	<u> </u>		

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE

PROPELLANT..... N₂H₄

VACUUM THRUST RANGE022-.587 N (.050-.132 lbf) (See attached figure)

INLET PRESSURE RANGE 86.1 - 272 N/cm² (125-395 PSIA) @ 40-95° F

INLET TEMPERATURE RANGE 4.4 - 76.6 °C (40-170 °F)

MINIMUM IMPULSE BIT 96.5 N/cm² INLET P, 93.3 °C CATALYST BED TEMP.

IMPULSE BIT REPEATABILITY @ 0.006 lbf-sec @ 140 PSIA, 200 °F CATALYST BED TEMP)
97.9 N/cm² (142 PSIA) INLET PRESSURE: < ± 8%
 3σ REPEATABILITY PULSE NUMBER - See also the
± % run-to-run repeatability
± % for a double mission
± % < + 10% spread,
 attached Figure 2.

CENTROID LOCATION REPEATABILITY FOR 100 sec VALVE ON-TIME: @ 142 psia): < ± 9%
 (70° F)
 3σ REPEATABILITY PULSE NUMBER
± %
± %
± %

CHAMBER PRESSURE ROUGHNESS ± 5 % @ ATP
 (+ 6.5% after 100,000 pulses)
 RESPONSE - (± 5 % after 50,000 pulses)

TIME FROM VALVE-ON SIGNAL TO 90% STEADY STATE P_c: _____ sec

TIME FROM VALVE-OFF SIGNAL TO 10% STEADY STATE P_c: _____ sec

STEADY STATE VACUUM SPECIFIC IMPULSE _____ N-sec/kg (220 lbf-sec/lbm) nominal at
 0.1-lbf - See
 LIFE - attached
 Fig. 3

TOTAL IMPULSE _____ N-sec (18x10³ lbf-sec)

TOTAL THROUGHPUT _____ kg (86 lbm)

TOTAL NUMBER OF COLD STARTS 20x10³ @ 4.4 °C (40 °F)

TOTAL NUMBER OF PULSES..... 1.0x10⁵

STEADY STATE DUTY CYCLE -

TOTAL ON-TIME 1.81x10⁵ sec

MAXIMUM ON-TIME 4.5x10⁴ sec

PULSE MODE DUTY CYCLE -

TEMPERATURE AT START OF PULSE TRAIN 93.3 to 176 °C (200-350 °F)

NOMINAL PULSE TRAIN LENGTH _____ PULSES

NOMINAL ON-TIME(S) 0.1 sec

NOMINAL OFF-TIME(S) 200 sec

*See attached table

P/N MR-74A

RANDOM VIBRATION -

WIDE BAND LEVEL	<u>17.0</u>	G_{rms}
MAX POWER SPECTRAL DENSITY	<u>0.16</u>	G^2/Hz from <u>250</u> to <u>2000</u> Hz

SINUSOIDAL VIBRATION -

SWEPT RATE	<u>2.0</u>	OCTAVES/min
MAX G LEVEL (0-PEAK)	<u>0.5 in</u>	AT <u>5-22</u> Hz
	<u>12.0</u>	AT <u>22-200</u> Hz
	<u>5.0</u>	AT <u>200-</u> Hz
		<u>2000</u>

ACoustic VIBRATION -

OVERALL SOUND PRESSURE LEVEL N/A dB FOR _____ MINUTES

SHOCK RESPONSE -

WAVE FORM PEAK-LEVEL OF N/A G's FOR _____ sec

SHOCK SPECTRUM-PEAK RESPONSE OF G's AT Hz

AMPLIFICATION FACTOR (Q)

STATIC ACCELERATION N/A G's

INJECTOR -

	Single SPVD	
PATTERN OF PROPELLANT DISTRIBUTION	41	
INJECTOR PRESSURE DROP AT FLOW RATE	60	
	N/cm ² @	.00020 kg/sec
	PCID @	.00045 lbm/sec

CATALYST -

TYPE	Shell 405	
PELLET SIZE(S)	25-30 mesh	
RETENTION TECHNIQUE	bed plate and screens	
BED DIAMETER	_____ cm	(<u>0.398</u> in)
BED LENGTH	_____ cm	(<u>0.500</u> in)
BED LOADING	_____ kg/sec/cm ²	(<u>0.0037</u> lbm/sec/in ²)

HEATER -

NOMINAL SUPPLY VOLTAGE	<u>26.0</u> Vdc,	
MAXIMUM POWER	<u>1.53</u> WATTS @ <u>27.3</u> Vdc,	_____ °C (_____ °F)
CATALYST BED TEMPERATURE	<u>107</u> °C	(<u>225</u> °F)

VALVE -

THRUSTER-VALVE INTERFACE DESCRIPTION Bolt flange

PROOF PRESSURE 413 N/cm² (600 PSIA)

BURST PRESSURE N/cm² (PSIA)

EXTERNAL LEAKAGE scc/s OF @ N/cm² (PSIA)

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE continued

MATERIAL -

CHAMBER	<u>CRES 347</u>
STANDOFF	<u>Haynes 25</u>
CATALYST RETAINER	<u>CRES 347</u>

MASS -

WITH VALVE	<u>Single.Seat.Valve...</u>	<u>0.29</u>	kg	(	<u>0.65</u>	lbm)
WITHOUT VALVE			kg	(		lbm)
OTHER	<u>Series.Redundant.Valve</u>	<u>0.34</u>	kg	(<u>0.75</u>	lbm)

OTHER SIGNIFICANT CHARACTERISTICS

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4.3.1-5

Figure 1

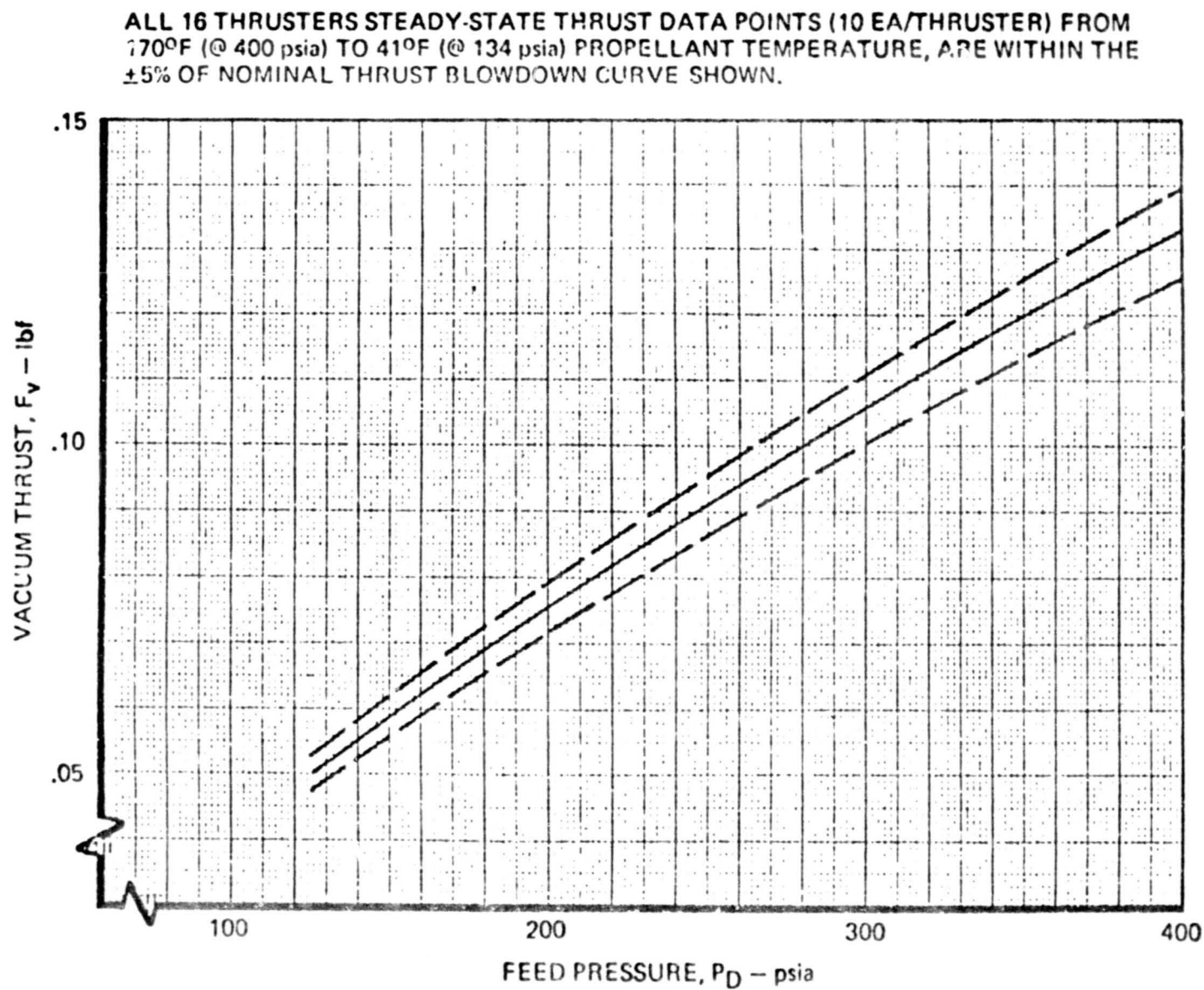


Figure 9. ATS F&G SPS Prototype Qualification Thermal Vacuum Test Thrust Blowdown

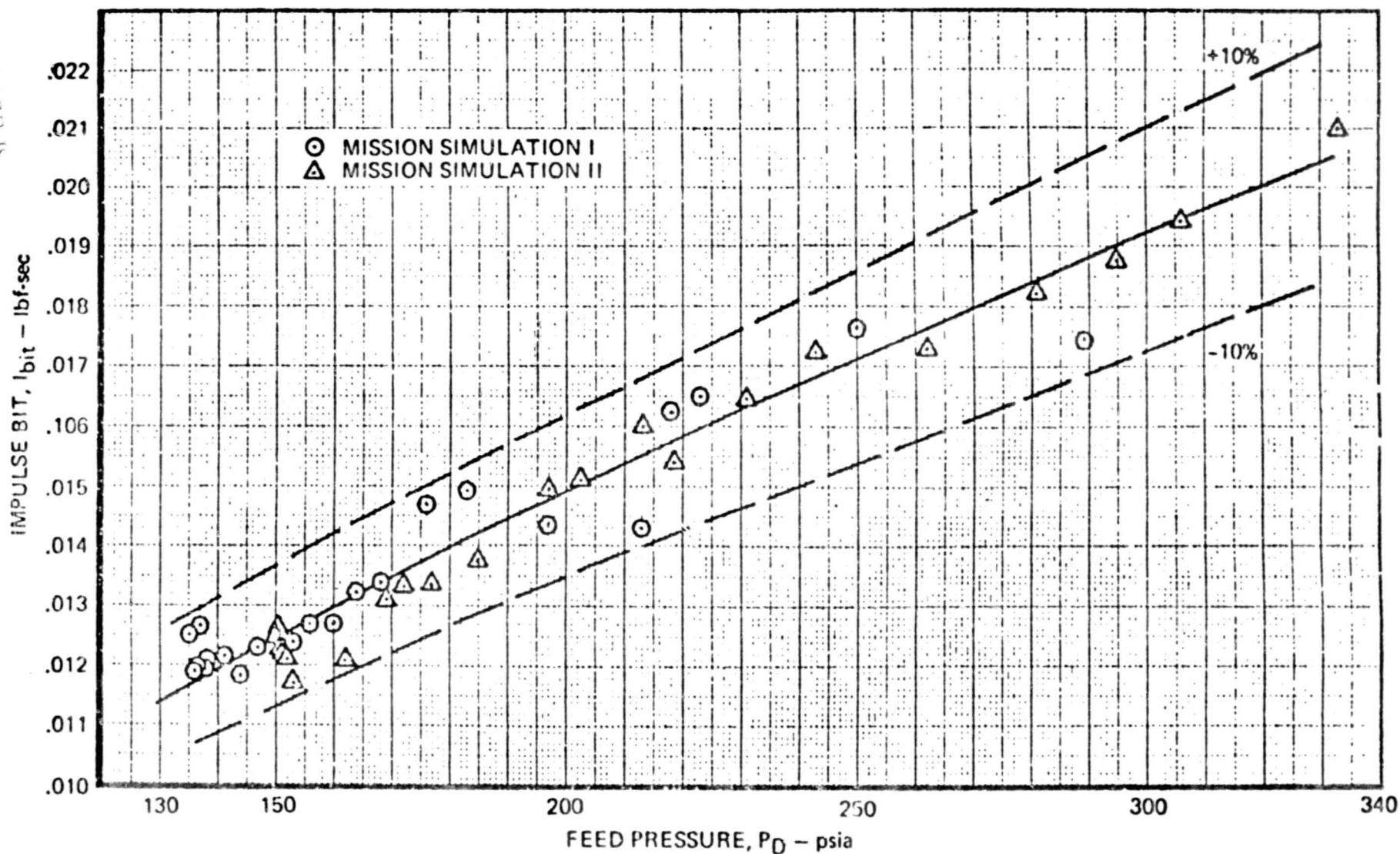
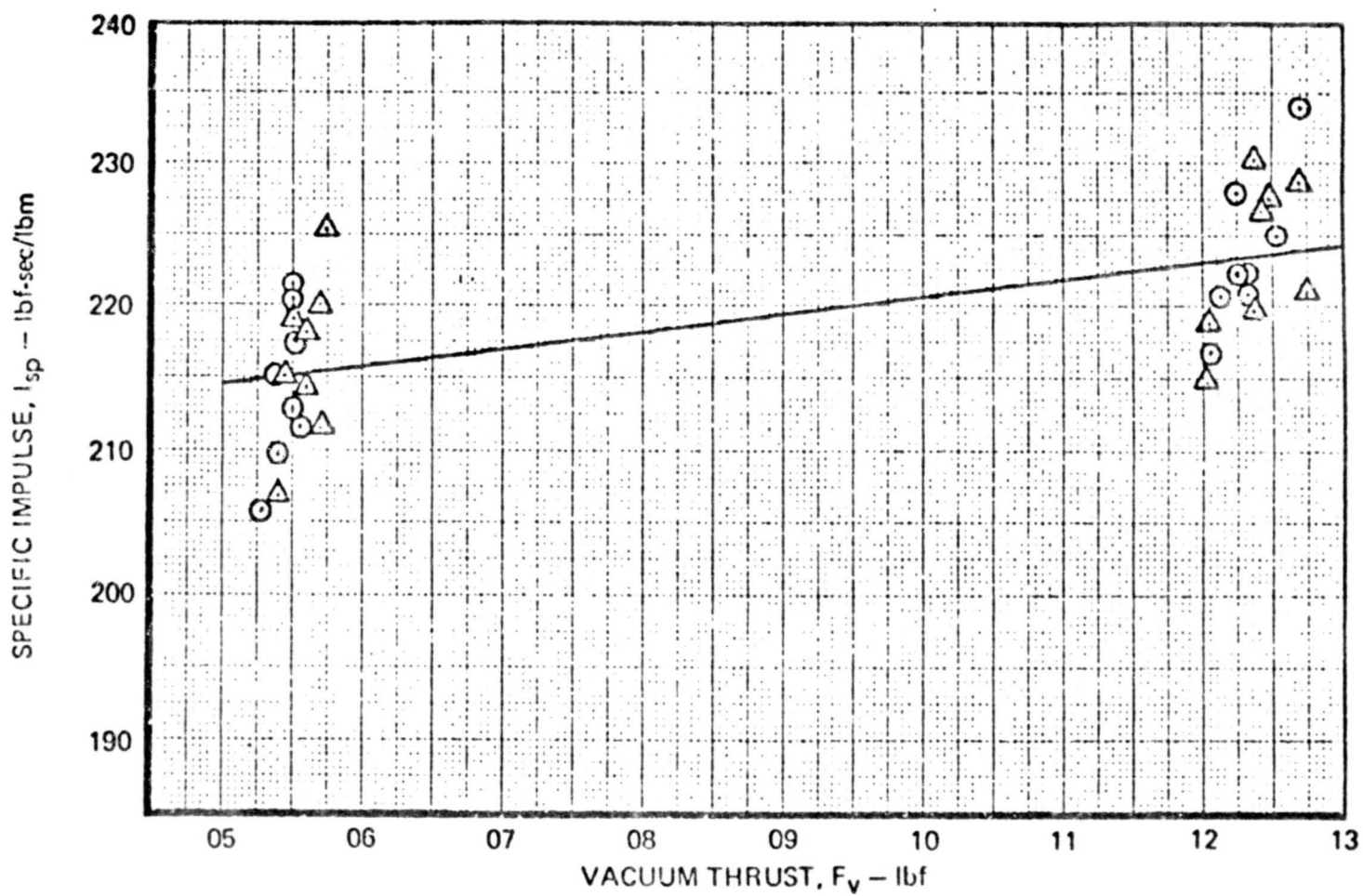


Figure 8. Engineering Model Test Mission Simulation Thruster #1
0.200 sec ON/10 sec OFF x 37,500 Pulses



ATS F&G (QUAL DATA, EVM & TRUSS(15 THRUSTERS), - No. 13

REPEATABILITY, \pm %

I_{Bit}	ON TIME	PULSE	@	400 psia & 95°F	@	134 psia & 40°F
	.1	1		6.1		3.5
	.1	5		9.4		8.5
	.2	1		5.8		4.9
	.2	25		5.4		3.9
Centroid	.1	1		6.1		11.4
	.1	5		9.4		13.4
	.2	1		3.0		3.7
	.2	25		1.6		5.0

MAXIMUM RESPONSE

PULSE MODE	@ .1 on /200 sec off	(Qual Data EVM + Truss) (16 Thrusters)
to 90%	.106 sec	
to 10%	.394 sec	
STEADY STATE		(S/N 1001, 1002, 1003 perf. map) (48 Thrusters)
to 90%	2.530 sec	
to 10%	.295 sec	

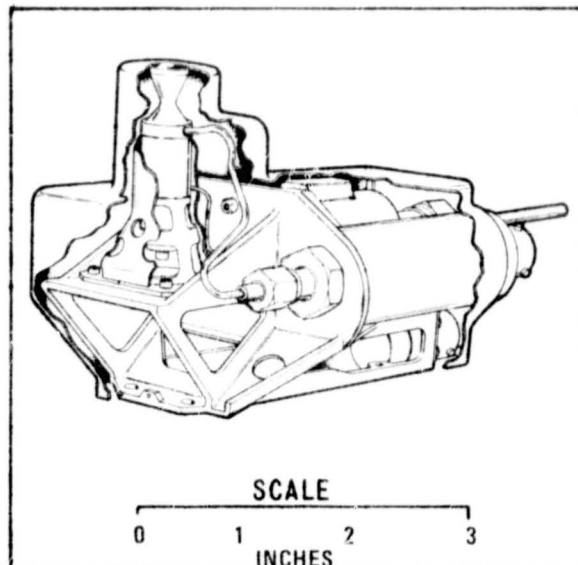
Note above data is maximum over entire pressure and temperature range.

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE

MANUFACTURER Bell Aerospace Co. (57)

PART NUMBER 8760



VALVE MANUFACTURER..... HR&M PART NUMBER 4800-2510

HEATER MANUFACTURER..... AVCO/Bell PART NUMBER

SENSOR MANUFACTURERS.....
 TEMPERATURE TRANSDUCER Rosemount PART NUMBER 118APJ

PRESSURE TRANSDUCER Satham PART NUMBER PA493-260

PROGRAM..... Low Cost Standardized Space Equipment

CONTRACTING AGENCY Bell Aerospace Company

PRIME CONTRACTOR

STATUS
 QUALIFIED DVT Completed; Qual. Scheduled for Summer '75.

FLOWN

LAUNCH VEHICLE Any SLV

AVAILABILITY 6 Months ARO

COST/PROCUREMENT INFORMATION...

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE

PROPELLANT.....	<u>N₂H₄</u>	<u>MIL-P-26536C</u>
VACUUM THRUST RANGE	<u>1.11 - 0.22</u> N	(<u>0.25 - 0.05</u> lbf)
INLET PRESSURE RANGE	<u>290 - 48</u> N/cm ²	(<u>420 - 70</u> PSIA)
INLET TEMPERATURE RANGE	<u>4.4 - 60</u> °C	(<u>40 - 140</u> °F)
MINIMUM IMPULSE BIT	<u>0.01</u> N-sec @ <u>242</u> N/cm ²	INLET P, <u>204</u> °C CATALYST BED TEMP.
	(<u>0.0024</u> lbf-sec @ <u>350</u> PSIA, <u>400</u> °F CATALYST BED TEMP)	
IMPULSE BIT REPEATABILITY @	<u>104-242</u> N/cm ² (<u>150-350</u> PSIA)	INLET PRESSURE:
	3σ REPEATABILITY	PULSE NUMBER
	<u>± 30.2</u> %	<u>Any</u>
	<u>± 1.5</u> %	<u>> 50</u>
	<u>±</u> %	
CENTROID LOCATION REPEATABILITY FOR <u>> 0.040</u> sec VALVE ON-TIME:		
	3σ REPEATABILITY	PULSE NUMBER
	<u>± 0.033</u> sec	<u>2-10</u>
	<u>± 0.020</u> sec	<u>11-50</u>
	<u>± 0.010</u> sec	<u>> 50</u>
CHAMBER PRESSURE ROUGHNESS	<u>± 7</u> %	3σ (maximum)
RESPONSE -		
TIME FROM VALVE-ON SIGNAL TO 90% STEADY STATE P _c :	<u>0.040</u> sec	
TIME FROM VALVE-OFF SIGNAL TO 10% STEADY STATE P _c :	<u>0.100</u> sec	- 10 vdc clipping
STEADY STATE VACUUM SPECIFIC IMPULSE	<u>2133</u> N-sec/kg	(<u>217.6</u> lbf-sec/lbm)
LIFE -		
TOTAL IMPULSE	<u>136.170</u> N-sec	(<u>30.600</u> lbf-sec)
TOTAL THROUGHPUT	<u>64</u> kg	(<u>141</u> lbm)
TOTAL NUMBER OF COLD STARTS	<u>500,000</u> @ <u>193</u> °C	(<u>380</u> °F)
TOTAL NUMBER OF PULSES.....	<u>507,000</u>	
STEADY STATE DUTY CYCLE -		
TOTAL ON-TIME	<u>1.47 x 10⁵</u> sec	(<u>40.7</u> hrs)
MAXIMUM ON-TIME	<u>1.08 x 10⁵</u> sec	(<u>30.0</u> hrs)
PULSE MODE DUTY CYCLE -		
TEMPERATURE AT START OF PULSE TRAIN	<u>204</u> °C	(<u>400</u> °F)
NOMINAL PULSE TRAIN LENGTH	<u>1 - 20,000</u> PULSES	
NOMINAL ON-TIME(S)	<u>0.008 - 2.0</u> sec	
NOMINAL OFF-TIME(S)	<u>0.012 - 1200</u> sec	

P/N 8760

RANDOM VIBRATION -

WIDE BAND LEVEL $\frac{29}{1.0}$ G_{rms}
MAX POWER SPECTRAL DENSITY $\frac{1.0}{1.0}$ G²/Hz from 40 to 600 Hz

SINUSOIDAL VIBRATION -

SWEEP RATE	<u>2</u>	OCTAVES/min
MAX G LEVEL (0-PEAK)	<u>30</u>	AT <u>27.1-80</u> Hz
	<u>20</u>	AT <u>80-150</u> Hz
	<u>10</u>	AT <u>150-2000</u> Hz

ACoustic VIBRATION -

OVERALL SOUND PRESSURE LEVEL 150 dB FOR 5 MINUTES

SHOCK RESPONSE -

WAVE FORM PEAK-LEVEL OF G's FOR sec

SHOCK SPECTRUM-PEAK RESPONSE OF 4300 G'S AT 10,000 Hz

AMPLIFICATION FACTOR (Q) 20

STATIC ACCELERATION 34 G's

INJECTOR -

PATTERN OF PROPELLANT DISTRIBUTION Vortex

INJECTOR PRESSURE DROP AT FLOW RATE 138 N/cm^2 @ 0.00041 kg/sec

(Including Valve and Lee Viscojet) (200 PSID @ 0.00091 lbm/sec)

CATALYST -

TYPE Shell 405 ABSG

PELLET SIZE(S) 20 - 30 Mesh

RETENTION TECHNIQUE Static Pre-Load, Single Bed

BED DIAMETER 1.08 cm (0.425 in)

BED LENGTH 1.50 cm (0.59 in)

BED LOADING 4.9×10^{-4} kg/sec/cm² (0.007 lbm/sec/in²)

HEATER - (Catalyst Bed/Valve)

NOMINAL SUPPLY VOLTAGE 28 Vdc.

MAXIMUM POWER 1.0/0.2 WATTS @ 31 V_{dc}, 204/4.4 °C (400/40 °F)

CATALYST BED TEMPERATURE 204 °C (400 °F)

VALVE -

THRUSTER-VALVE INTERFACE DESCRIPTION	Flanged, Redundant Omega Seals
--	--------------------------------

PROOF PRESSURE 580 N/cm² (840 PSIG)

BURST PRESSURE 1160 N/cm² (1680 PSIG)

EXTERNAL LEAKAGE 10^{-6} SCC/S OF He @ 290 N/cm² (420 PSIA)

Internal Leakage	1.0 scc/hr	GN ₂ @ 290 N/cm ²
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ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE continued

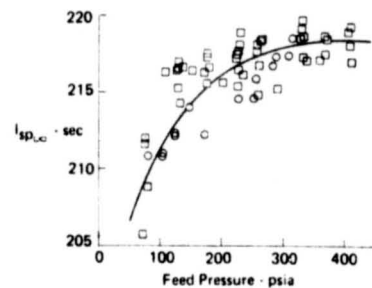
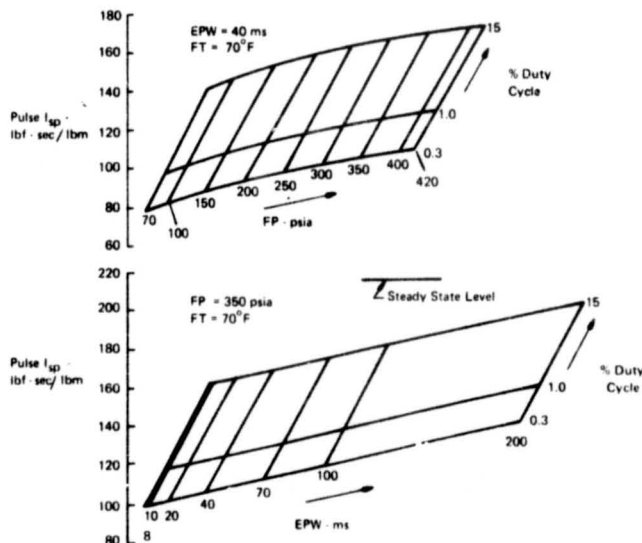
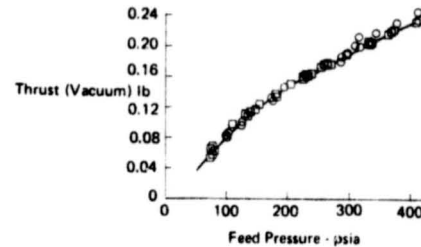
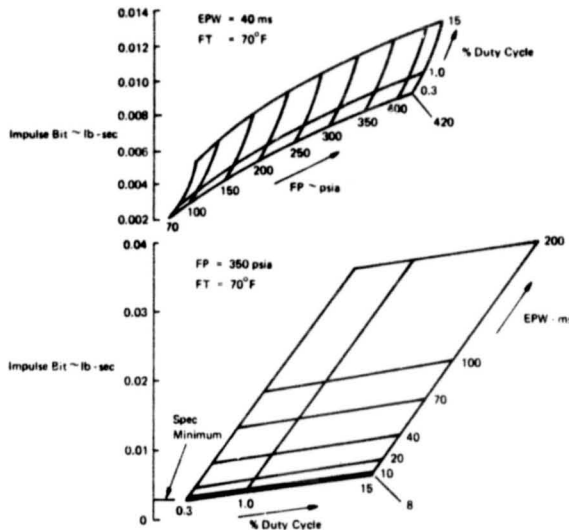
MATERIAL -

CHAMBER	L605
STANDOFF	L605
CATALYST RETAINER	L605, Pt -Rh Screen

MASS -

WITH VALVE	0.39 kg	(0.86 lbm)
WITHOUT VALVE	0.30 kg	(0.67 lbm)
OTHER - Without P_c Transducer	0.24 kg	(0.53 lbm)

OTHER SIGNIFICANT CHARACTERISTICS

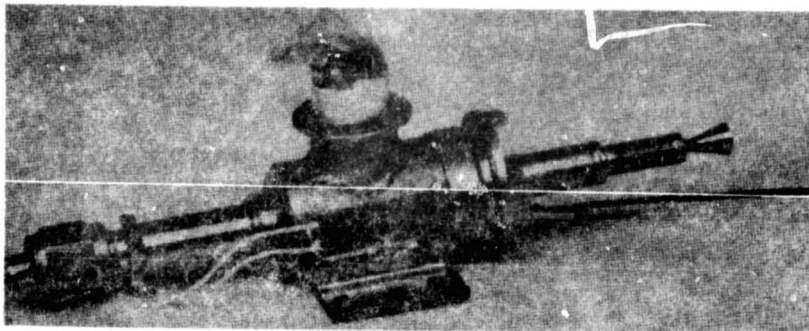


ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE

MANUFACTURER TRW Systems Group (28)

PART NUMBER MRE-0.1



VALVE MANUFACTURER..... Parker-Hannifin PART NUMBER _____

HEATER MANUFACTURER..... _____ PART NUMBER _____

SENSOR MANUFACTURERS.....

TEMPERATURE TRANSDUCER _____ PART NUMBER _____

PRESSURE TRANSDUCER _____ PART NUMBER _____

PROGRAM..... FLTSATCOM

CONTRACTING AGENCY SAMSO

PRIME CONTRACTOR TRW Systems

STATUS

QUALIFIED Qualification completion scheduled for 8/74

FLOWN _____

LAUNCH VEHICLE ATLAS CENTAUR

AVAILABILITY 8 months ARO

COST/PROCUREMENT INFORMATION... _____

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE

PROPELLANT..... MIL-P-26536C, Hydrazine

VACUUM THRUST RANGE 1.11-0.22 N (0.25-0.05 lbf)

INLET PRESSURE RANGE 238-40.8 N/cm² (350-60 PSIA)

INLET TEMPERATURE RANGE 5-60 °C (40-140 °F)

MINIMUM IMPULSE BIT0133 N-sec @ 238 N/cm² INLET P, 232 °C CATALYST BED TEMP.
(.003 lbf-sec @ 350 PSIA, 450 °F CATALYST BED TEMP)

IMPULSE BIT REPEATABILITY @ 238 N/cm² (350 PSIA) INLET PRESSURE:
3σ REPEATABILITY PULSE NUMBER

± 10 % _____
± _____ % _____
± _____ % _____

CENTROID LOCATION REPEATABILITY FOR .020 sec VALVE ON-TIME:
3σ REPEATABILITY PULSE NUMBER

± 20 % _____
± _____ % _____
± _____ % _____

CHAMBER PRESSURE ROUGHNESS ± 5 % _____

RESPONSE -
TIME FROM VALVE-ON SIGNAL TO 90% STEADY STATE P_c: 0.020 sec
TIME FROM VALVE-OFF SIGNAL TO 10% STEADY STATE P_c: 0.050 sec

STEADY STATE VACUUM SPECIFIC IMPULSE 2234 N-sec/kg (228 lbf-sec/lbm)

LIFE -
TOTAL IMPULSE 66,700 N-sec (15,000 lbf-sec)
TOTAL THROUGHPUT 30.4 kg (67 lbm)
TOTAL NUMBER OF COLD STARTS 400,000 @ 232 °C (450 °F)
TOTAL NUMBER OF PULSES..... 400,000

STEADY STATE DUTY CYCLE -
TOTAL ON-TIME 150,000 sec
MAXIMUM ON-TIME 29,000 sec

PULSE MODE DUTY CYCLE -
TEMPERATURE AT START OF PULSE TRAIN 232 °C (450 °F)
NOMINAL PULSE TRAIN LENGTH unlimited PULSES
NOMINAL ON-TIME(S) 0.020 sec
NOMINAL OFF-TIME(S) 30 sec

P/N MRE-0.1

RANDOM VIBRATION -

WIDE BAND LEVEL G_{rms}
MAX POWER SPECTRAL DENSITY G^2/Hz from _____ to _____ Hz

SINUSOIDAL VIBRATION -

SWEEP RATE OCTAVES/min
MAX G LEVEL (0-PEAK) AT Hz
..... AT Hz
..... AT Hz

ACUSTIC VIBRATION -

OVERALL SOUND PRESSURE LEVEL dB FOR MINUTES

SHOCK RESPONSE -

WAVE FORM PEAK-LEVEL OF G's FOR sec
SHOCK SPECTRUM-PEAK RESPONSE OF G's AT Hz
AMPLIFICATION FACTOR (Q)

STATIC ACCELERATION

INJECTOR -

PATTERN OF PROPELLANT DISTRIBUTION

INJECTOR PRESSURE DROP AT FLOW RATE

Single tube

34 N/cm² @ 0.00021 kg/sec
(50 PSID @ 0.00046 lbm/sec)

CATALYST -

TYPE

PELLET SIZE(S)

RETENTION TECHNIQUE

BED DIAMETER

BED LENGTH

BED LOADING

She11 405 ABSG

25-30 Mesh

Preloaded Screens

0.51 cm (0.20 in)

1.27 cm (0.50 in)

0.00207 kg/sec/cm² (0.03 lbm/sec/in²)

HEATER -

NOMINAL SUPPLY VOLTAGE

MAXIMUM POWER

CATALYST BED TEMPERATURE

15 Vdc,

2.5 WATTS @ 15 V_{DC}, 288 °C (550 °F)

288 °C (550 °F)

VALVE -

THRUSTER-VALVE INTERFACE DESCRIPTION

Flange-mounted, Gold Plate V Seal

PROOF PRESSURE

680.2 N/cm² (1000 PSIA)

BURST PRESSURE

816.2 N/cm² (1200 PSIA)

EXTERNAL LEAKAGE

0.36 scc/s OF GN₂ @ 238 N/cm² (350 PSIA)

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

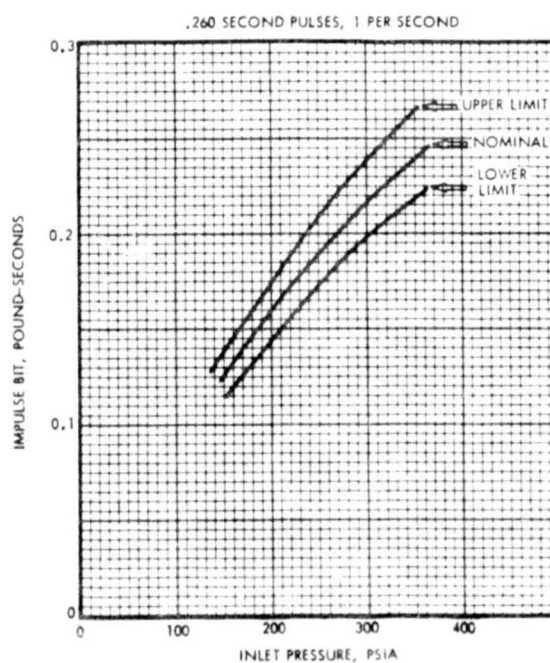
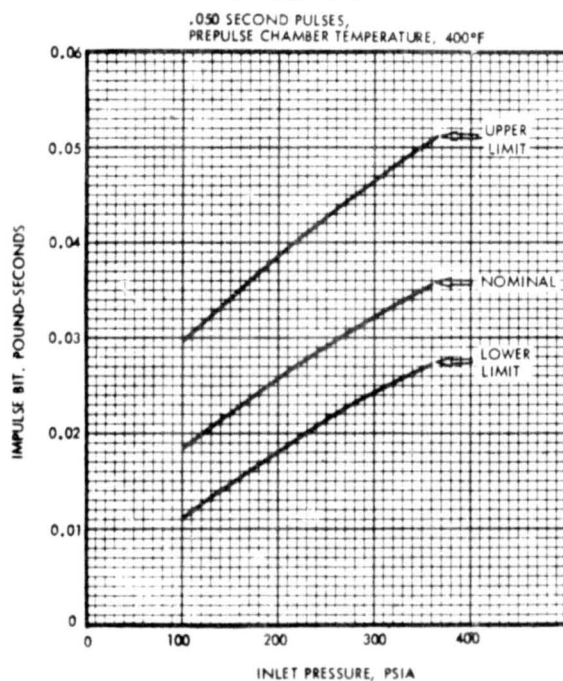
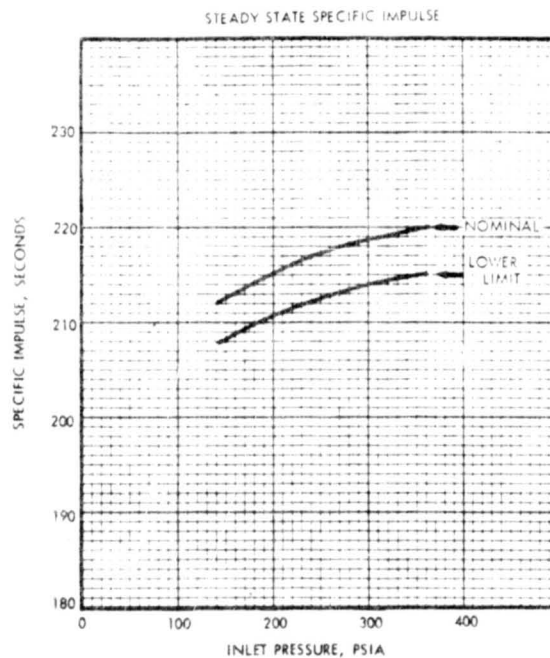
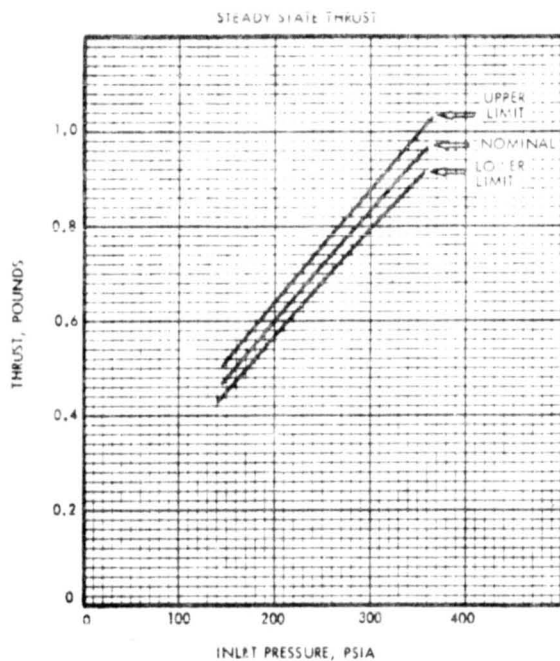
4.3.1 THRUSTER, HYDRAZINE continued

MATERIAL -

CHAMBER	Haynes 25
STANDOFF	Haynes 25
CATALYST RETAINER	Haynes 25

MASS -

WITH VALVE	_____ kg	(_____ lbm)
WITHOUT VALVE	_____ kg	(_____ lbm)
OTHER	0.27 kg	(0.6 lbm)



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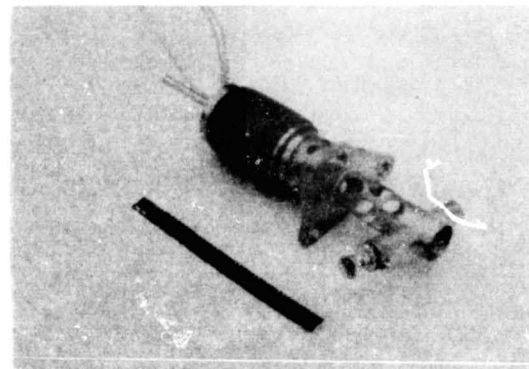
ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE

MANUFACTURER Hamilton Standard (32)

MODEL NO. REA 10-15

PART NUMBER SV 748525



CHAM. VALVE	VALVE MANUFACTURER.....	<u>Wright</u>	PART NUMBER	<u>15617-4</u>
	HEATER MANUFACTURER.....	<u>TSI</u>	PART NUMBER	<u>1137-4</u>
	Heater Manufacturer	<u>TSI</u>	Part Number	<u>76-3797-B</u>
	SENSOR MANUFACTURERS.....			
	TEMPERATURE TRANSDUCER	<u>TSI</u>	PART NUMBER	<u>5156-1</u>
	PRESSURE TRANSDUCER		PART NUMBER	
	PROGRAM.....	<u>Communications Technology Satellite (CTS)</u>		
	CONTRACTING AGENCY	<u>Communications Research Center, Canada</u>		
	PRIME CONTRACTOR	<u>Canadian Government</u>		
	STATUS			
	QUALIFIED	<u>Yes, will fly in 1975</u>		
	FLOWN	<u>Similar to model flown on SOLRAD X</u>		
	LAUNCH VEHICLE			
	AVAILABILITY	<u>Production status</u>		
	COST/PROCUREMENT INFORMATION...			

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE

PROPELLANT.....	<u>N₂H₄</u>	
VACUUM THRUST RANGE	<u>0.42-1.11</u> N	(<u>.095-.25</u> lbf)
INLET PRESSURE RANGE	<u>72-207</u> N/cm ²	(<u>105-300</u> PSIA)
INLET TEMPERATURE RANGE	<u>7-71</u> °C	(<u>45-160</u> °F)
MINIMUM IMPULSE BIT	<u>.0076</u> N-sec @ <u>72</u> N/cm ² INLET P, <u>171</u> °C CATALYST BED TEMP. (<u>.0017</u> lbf-sec @ <u>105</u> PSIA, <u>340</u> °F CATALYST BED TEMP)	
IMPULSE BIT REPEATABILITY @	<u>72</u> N/cm ² (<u>105</u> PSIA) INLET PRESSURE: 3σ REPEATABILITY PULSE NUMBER <u>± 15</u> % <u>±</u> % <u>±</u> %	
CENTROID LOCATION REPEATABILITY FOR _____ sec VALVE ON-TIME:	3σ REPEATABILITY PULSE NUMBER <u>±</u> % <u>±</u> % <u>±</u> %	
CHAMBER PRESSURE ROUGHNESS	<u>±</u> %	
RESPONSE -		
TIME FROM VALVE-ON SIGNAL TO 90% STEADY STATE P _c :	_____ sec	
TIME FROM VALVE-OFF SIGNAL TO 10% STEADY STATE P _c :	_____ sec	
STEADY STATE VACUUM SPECIFIC IMPULSE	<u>2226</u> N-sec/kg	(<u>227</u> lbf-sec/lbm)
LIFE -		
TOTAL IMPULSE	<u>4893</u> N-sec	(<u>1100</u> lbf-sec)
TOTAL THROUGHPUT	<u>3.3</u> kg	(<u>7.2</u> lbm)
TOTAL NUMBER OF COLD STARTS	<u>104</u> @ <u>93-260</u> °C	(<u>200-500</u> °F)
TOTAL NUMBER OF PULSES.....	<u>>350,000</u>	
STEADY STATE DUTY CYCLE -		
TOTAL ON-TIME	<u>4600</u> sec	
MAXIMUM ON-TIME	<u>3600</u> sec	
PULSE MODE DUTY CYCLE -		
TEMPERATURE AT START OF PULSE TRAIN	<u>171</u> °C	(<u>340</u> °F)
NOMINAL PULSE TRAIN LENGTH	<u>10</u> PULSES	
NOMINAL ON-TIME(S)	<u>.007</u> sec	
NOMINAL OFF-TIME(S)	<u>100</u> sec	

P/N SV 748525

RANDOM VIBRATION -

WIDE BAND LEVEL $\frac{9.2}{\text{G}_{\text{rms}}}$
 MAX POWER SPECTRAL DENSITY $\frac{.045}{\text{G}^2/\text{Hz}}$ from 300 to 2000 Hz

SINUSOIDAL VIBRATION -

SWEEP RATE 4 OCTAVES/min

MAX G LEVEL (0-PEAK) 12 AT 25 - 120 Hz

..... 10 AT 120 - 2000 Hz

..... AT Hz

ACOUSTIC VIBRATION -

OVERALL SOUND PRESSURE LEVEL dB FOR MINUTES

SHOCK RESPONSE -

WAVE FORM PEAK-LEVEL OF 13 G's FOR sec
SHOCK SPECTRUM-PEAK RESPONSE OF G's AT Hz
AMPLIFICATION FACTOR (Q)

STATIC ACCELERATION

INJECTOR -

PATTERN OF PROPELLANT DISTRIBUTION Single element, Penetrating injector

INJECTOR PRESSURE DROP AT FLOW RATE $\frac{62}{90}$ N/cm² @ $\frac{.0005}{.0011}$ kg/sec
(..... PSID @ lbm/sec)

CATALYST -

TYPE Shell 405 ABSG

PELLET SIZE(S) 30-35

RETENTION TECHNIQUE Dual Screen retained by nozzle

BED DIAMETER 0.69 cm (.271 in)

BED LENGTH 0.86 cm (.337 in)

BED LOADING $.0005 - .0013$ kg/sec/cm² ($.0074 - .019$ lbm/sec/in²)

HEATER -

NOMINAL SUPPLY VOLTAGE 14 Vdc.

MAXIMUM POWER 1.15 WATTS @ 14 V_{dc}, _____ °C (_____ °F)

CATALYST BED TEMPERATURE 171 °C (340 °F)

VALVE -

THRUSTER-VALVE INTERFACE DESCRIPTION Welded

PROOF PRESSURE 310 N/cm² (450 PSIA)

BURST PRESSURE 965 N/cm² (1400 PSIA)

EXTERNAL LEAKAGE 1×10^{-6} scc/s OF He @ 273 ± 17 W/cm² (396 ± 25 PSIA)

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE continued

MATERIAL -

CHAMBER Inconel 600
 STANDOFF Inconel 625
 CATALYST RETAINER L-605

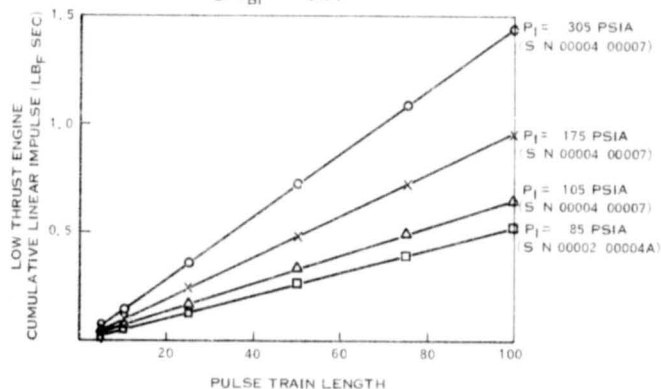
MASS -

WITH VALVE 0.16 kg (0.35 lbm)
 WITHOUT VALVE kg (lbm)
 OTHER kg (lbm)

OTHER SIGNIFICANT CHARACTERISTICS

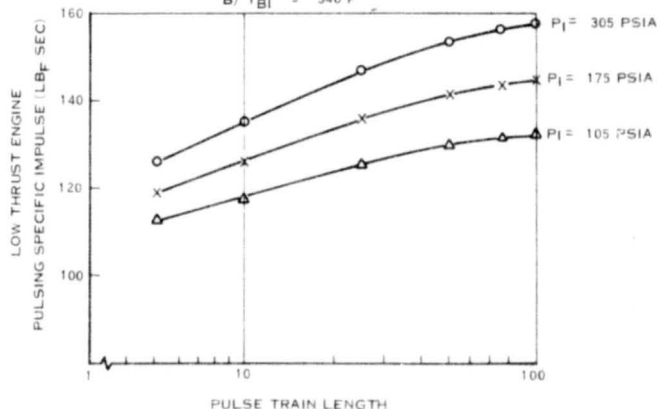
CTS LTE REA 10-15
 CUMULATIVE LINEAR IMPULSE BIT
 VS. PULSE TRAIN LENGTH FOR
 PITCH MOMENTUM DUMPING
 TEST CONDITIONS:

A) DUTY CYCLE
 $T_{ON} = 0.050$ SECONDS
 $T_{OFF} = 15.0$ SECONDS
 B) $T_{BI} = 340^{\circ}F$



LTE REA 10-15
 S N 00004 00007
 PULSING SPECIFIC IMPULSE
 VS. PULSE TRAIN LENGTH FOR
 PITCH MOMENTUM DUMPING
 TEST CONDITIONS:

A) DUTY CYCLE
 $T_{ON} = 0.50$ SECONDS
 $T_{OFF} = 15.0$ SECONDS
 B) $T_{BI} = 340^{\circ}F$



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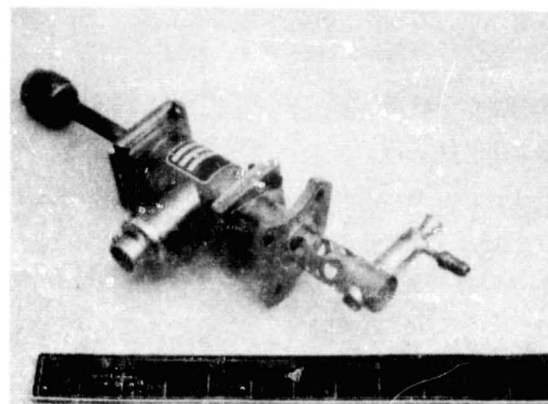
ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE

MANUFACTURER Hamilton Standard (32)

MODEL NO. R.E.A. 10-16

PART NUMBER SV755437



VALVE MANUFACTURER..... Wright Components PART NUMBER _____

HEATER MANUFACTURER..... _____ PART NUMBER _____

SENSOR MANUFACTURERS.....

TEMPERATURE TRANSDUCER PART NUMBER _____

PRESSURE TRANSDUCER PART NUMBER _____

PROGRAM..... Multiple Satellite Dispenser (MSD)

CONTRACTING AGENCY Naval Research Lab

PRIME CONTRACTOR _____

STATUS

QUALIFIED Some class that has flown on Solrad X.

FLOWN Qualified scheduled MSD flight is 1975.

LAUNCH VEHICLE _____

AVAILABILITY Production Status

COST/PROCUREMENT INFORMATION... _____

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE

PROPELLANT..... N₂H₄

VACUUM THRUST RANGE49-.93 N (.11-.21 lbf)

INLET PRESSURE RANGE 86-172 N/cm² (125-250 PSIA)

INLET TEMPERATURE RANGE 5 to 50 °C (41 to 122 °F)

MINIMUM IMPULSE BIT031 N-sec @ 86 N/cm² INLET P, 538°C CATALYST BED TEMP.
(.007 lbf-sec @ 125 PSIA, 1000 °F CATALYST BED TEMP)

IMPULSE BIT REPEATABILITY @ 172 N/cm² (250 PSIA) INLET PRESSURE:
3σ REPEATABILITY PULSE NUMBER

<u>± 10.7</u> %	<u>1-100</u>
<u>±</u> %	
<u>± 6.3</u> %	<u>20-100</u>

CENTROID LOCATION REPEATABILITY FOR 0.60 sec VALVE ON-TIME:
3σ REPEATABILITY PULSE NUMBER

<u>± 22.6</u> %	<u>1-100</u>
<u>±</u> %	
<u>± 15</u> %	<u>10-100</u>

CHAMBER PRESSURE ROUGHNESS %

RESPONSE -

TIME FROM VALVE-ON SIGNAL TO 90% STEADY STATE P_c: .026 sec

TIME FROM VALVE-OFF SIGNAL TO 10% STEADY STATE P_c: .066 sec

STEADY STATE VACUUM SPECIFIC IMPULSE 2206 N-sec/kg (225 lbf-sec/lbm)

LIFE -

TOTAL IMPULSE	<u>72,772</u> N-sec	<u>16,360</u> (<u></u> lbf-sec)
TOTAL THROUGHPUT	<u>36.3</u> kg	(<u>80</u> lbm)
TOTAL NUMBER OF COLD STARTS	<u>228</u> @ <u>32</u> °C	(<u>90</u> °F)
TOTAL NUMBER OF PULSES.....	<u>375,000</u>	

STEADY STATE DUTY CYCLE -

TOTAL ON-TIME	<u>86,400</u> sec
MAXIMUM ON-TIME	<u>7,200</u> sec

PULSE MODE DUTY CYCLE -

TEMPERATURE AT START OF PULSE TRAIN	<u>32</u> °C	(<u>90</u> °F)
NOMINAL PULSE TRAIN LENGTH	<u>100</u> PULSES	
NOMINAL ON-TIME(S)	<u>.060</u> sec	
NOMINAL OFF-TIME(S)	<u>.940</u> sec	

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE continued

P/N SV755437

LAUNCH ENVIRONMENT -

RANDOM VIBRATION -

WIDE BAND LEVEL 6 G_{rms}
 MAX POWER SPECTRAL DENSITY G^2/Hz from _____ to _____ Hz

SINUSOIDAL VIBRATION -

SWEEP RATE OCTAVES/min
 MAX G LEVEL (O-PEAK) 11 AT _____ Hz
 _____ AT _____ Hz
 _____ AT _____ Hz

ACOUSTIC VIBRATION -

OVERALL SOUND PRESSURE LEVEL dB FOR _____ MINUTES

SHOCK RESPONSE -

WAVE FORM PEAK-LEVEL OF G's FOR _____ sec
 SHOCK SPECTRUM-PEAK RESPONSE OF G's AT _____ Hz
 AMPLIFICATION FACTOR (Q)

STATIC ACCELERATION G's

INJECTOR -

PATTERN OF PROPELLANT DISTRIBUTION Single element, Penetrating Injector

INJECTOR PRESSURE DROP AT FLOW RATE 62 N/cm^2 @ .0005 kg/sec
 (90 PSID @ .0011 lbm/sec)

CATALYST -

TYPE Shell 405 ABSG
 PELLET SIZE(S) 30-35
 RETENTION TECHNIQUE Oval Screen Retained by Nozzle

BED DIAMETER68 cm (.268 in)
 BED LENGTH86 cm (.337 in)
 BED LOADING0006- kg/sec/cm² (.009- lbm/sec/in²)
.0012

HEATER -

NOMINAL SUPPLY VOLTAGE Vdc,
 MAXIMUM POWER WATTS @ _____ Vdc, _____ °C (_____ °F)
 CATALYST BED TEMPERATURE °C (_____ °F)

VALVE -

THRUSTER-VALVE INTERFACE DESCRIPTION

PROOF PRESSURE 414 N/cm^2 (600 PSIA)

BURST PRESSURE 965 N/cm^2 (1400 PSIA)

EXTERNAL LEAKAGE scc/s OF _____ @ _____ N/cm^2 (_____ PSIA)

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE continued

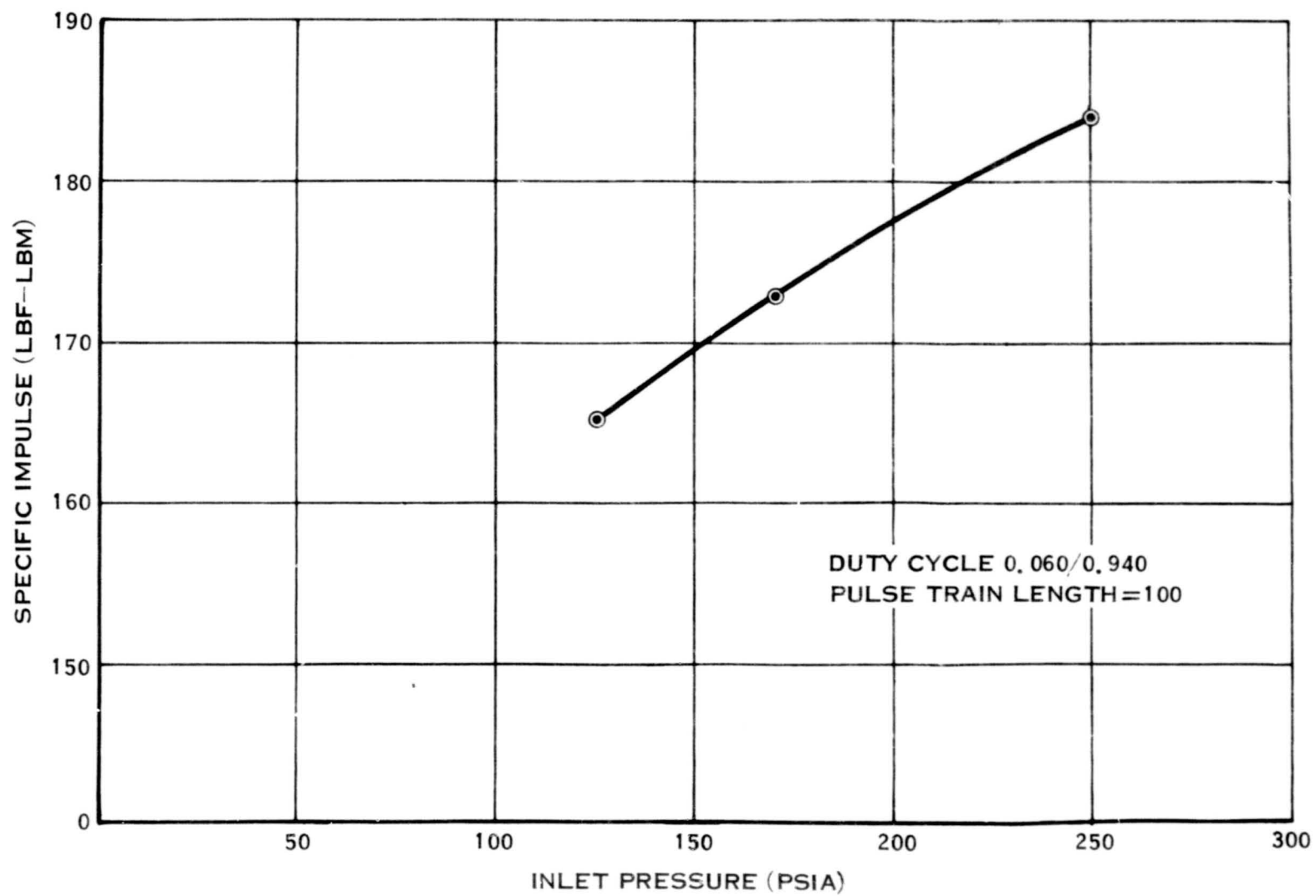
MATERIAL -

CHAMBER	<u>Inconel 600</u>
STANDOFF	<u>347 Cres</u>
CATALYST RETAINER	<u>L-605</u>

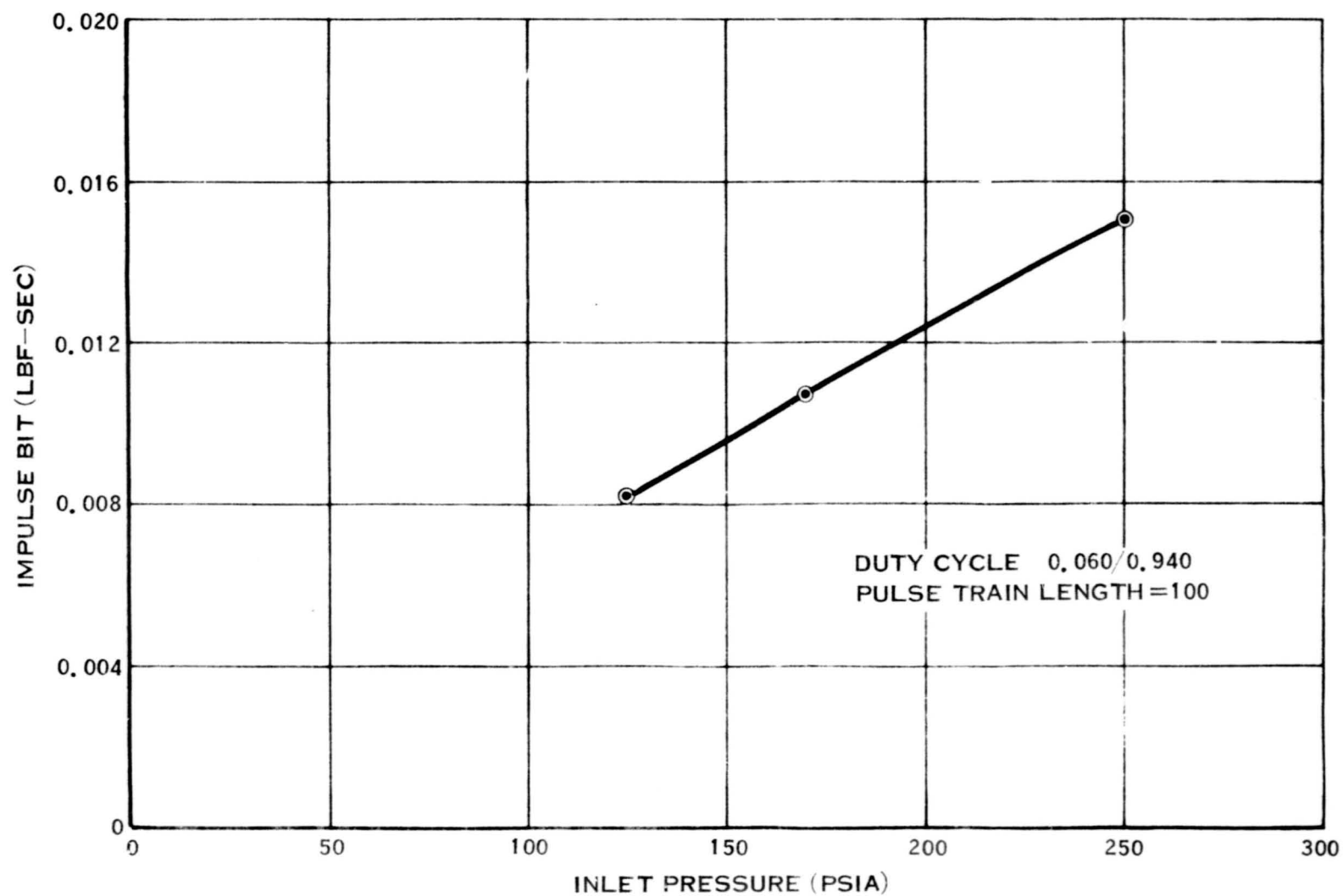
MASS -

WITH VALVE	<u>.21</u> kg	(<u>.48</u> lbm)
WITHOUT VALVE	_____ kg	(_____ lbm)
OTHER	_____ kg	(_____ lbm)

OTHER SIGNIFICANT CHARACTERISTICS



4.3.1-26

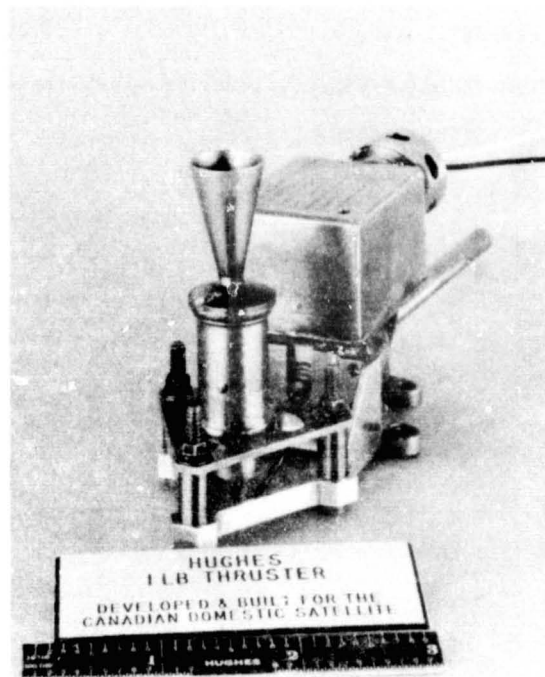


ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE

MANUFACTURER Hughes Aircraft Co. (52)

PART NUMBER 3251415-101



VALVE MANUFACTURER..... PART NUMBER _____

HEATER MANUFACTURER..... PART NUMBER _____

SENSOR MANUFACTURERS.....

TEMPERATURE TRANSDUCER PART NUMBER _____

PRESSURE TRANSDUCER PART NUMBER _____

PROGRAM..... Anik, Westar, Marisat

CONTRACTING AGENCY Telesat Corp., Western Union, Comsat Corp.

PRIME CONTRACTOR _____

STATUS

QUALIFIED completed

FLOWN yes

LAUNCH VEHICLE _____

AVAILABILITY 9 mo. lead time

COST/PROCUREMENT INFORMATION... \$18,000

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE

N_2H_4

PROPELLANT.....

VACUUM THRUST RANGE $7.1 - 1.1$ N ($1.6 - .25$ lb_f)

INLET PRESSURE RANGE $248 - 27$ N/cm² ($360 - 40$ PSIA)

INLET TEMPERATURE RANGE 4.4 to 60 °C (40 to 140 °F)

MINIMUM IMPULSE BIT $.778$ N-sec @ _____ N/cm² INLET P, _____ °C CATALYST BED TEMP.
($.175$ lb_f -sec @ _____ PSIA, _____ °F CATALYST BED TEMP)

IMPULSE BIT REPEATABILITY @ N/cm² (_____ PSIA) INLET PRESSURE:
3σ REPEATABILITY PULSE NUMBER
± 10 %
± %
± %

CENTROID LOCATION REPEATABILITY FOR $100m$ sec VALVE ON-TIME:
3σ REPEATABILITY PULSE NUMBER
± 10 %
± %
± %

CHAMBER PRESSURE ROUGHNESS 5 %

RESPONSE -
TIME FROM VALVE-ON SIGNAL TO 90% STEADY STATE P_c : 35 m sec
TIME FROM VALVE-OFF SIGNAL TO 10% STEADY STATE P_c : 40 m sec

STEADY STATE VACUUM SPECIFIC IMPULSE N-sec/kg (225 lb_f -sec/lbm)

LIFE -
TOTAL IMPULSE $160,128$ N-sec ($36,000$ lb_f -sec)
TOTAL THROUGHPUT 74.8 kg (165 lbm)
TOTAL NUMBER OF COLD STARTS 700 @ $+5$ °C ($+41$ °F)
TOTAL NUMBER OF PULSES..... $35,000$

STEADY STATE DUTY CYCLE -
TOTAL ON-TIME $35,000$ sec
MAXIMUM ON-TIME 1600 sec

PULSE MODE DUTY CYCLE -
TEMPERATURE AT START OF PULSE TRAIN $+60$ °C ($+140$ °F)
NOMINAL PULSE TRAIN LENGTH $5 - 5000$ PULSES
NOMINAL ON-TIME(S) $.075$ sec
NOMINAL OFF-TIME(S) $.525$ sec

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE continued

P/N 3251415-101

LAUNCH ENVIRONMENT - RANDOM VIBRATION -

WIDE BAND LEVEL G_{rms}
MAX POWER SPECTRAL DENSITY G^2/Hz from _____ to _____ Hz

SINUSOIDAL VIBRATION -

SWEEP RATE OCTAVES/min
MAX G LEVEL (0-PEAK) AT _____ Hz
..... AT _____ Hz
..... AT _____ Hz

ACOUSTIC VIBRATION -

OVERALL SOUND PRESSURE LEVEL dB FOR _____ MINUTES

SHOCK RESPONSE -

WAVE FORM PEAK-LEVEL OF G's FOR _____ sec
SHOCK SPECTRUM-PEAK RESPONSE OF G's AT _____ Hz
AMPLIFICATION FACTOR (Q)

STATIC ACCELERATION G's

INJECTOR -

PATTERN OF PROPELLANT DISTRIBUTION 4 x 4 axial and radial

INJECTOR PRESSURE DROP AT FLOW RATE N/cm^2 @ _____ kg/sec
(..... PSID @ lbm/sec)

CATALYST -

TYPE Shell 405 ABSG
PELLET SIZE(S) 14-18, 20-30
RETENTION TECHNIQUE Screen covered perforated plate
BED DIAMETER 1.34 cm (.530 in)
BED LENGTH 2.64 cm (1.04 in)
BED LOADING $kg/sec/cm^2$ (..... lbm/sec/in²)

HEATER -

NOMINAL SUPPLY VOLTAGE Vdc,
MAXIMUM POWER WATTS @ _____ Vdc, _____ °C (_____ °F)
CATALYST BED TEMPERATURE °C (_____ °F)

VALVE -

Series redundant hard seat torque motor operated

THRUSTER-VALVE INTERFACE DESCRIPTION

PROOF PRESSURE 424 N/cm^2 (615 PSIA)
BURST PRESSURE 1113 N/cm^2 (1615 PSIA)
EXTERNAL LEAKAGE 0 scc/s OF gas @ 241 N/cm^2 (350 PSIA)

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE continued

MATERIAL -

CHAMBER Cobalt (L605) and Nickel (Inconel 600)
STANDOFF
CATALYST RETAINER

MASS -

WITH VALVE	<u>.403</u> kg	(<u>.888</u> lbm)
WITHOUT VALVE	_____ kg	(_____ lbm)
OTHER valve only	<u>.2676</u> kg	(<u>.5900</u> lbm)

OTHER SIGNIFICANT CHARACTERISTICS

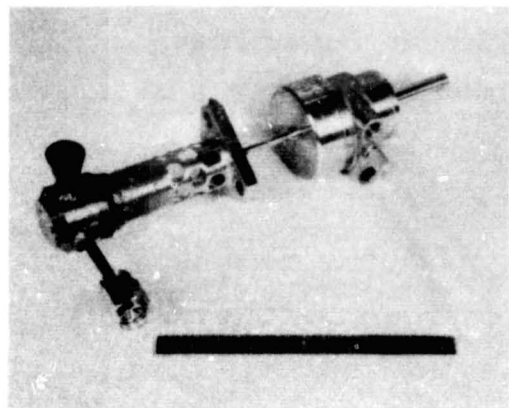
ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE

MANUFACTURER Hamilton Standard (32)

MODEL NO. REA 17-7

PART NUMBER SV748562



VALVE MANUFACTURER.....	<u>Parker Aircraft</u>	PART NUMBER	<u>5720002</u>
HEATER MANUFACTURER.....	<u>TSI</u>	PART NUMBER	<u>76-3764-1</u>
SENSOR MANUFACTURERS.....			
TEMPERATURE TRANSDUCER	<u>TSI</u>	PART NUMBER	<u>5148-3</u>
PRESSURE TRANSDUCER		PART NUMBER	
PROGRAM.....	<u>Classified</u>		
CONTRACTING AGENCY			
PRIME CONTRACTOR	<u>LSMS</u>		
STATUS			
QUALIFIED			
FLOWN	<u>Flown</u>		
LAUNCH VEHICLE			
AVAILABILITY	<u>Production status</u>		
COST/PROCUREMENT INFORMATION...			

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE

PROPELLANT..... N₂H₄

VACUUM THRUST RANGE 1.5-2.2 N (.34-.50 lbf)

INLET PRESSURE RANGE 117-176 N/cm² (170-255 PSIA)

INLET TEMPERATURE RANGE 4 to 43 °C (40 to 110 °F)

MINIMUM IMPULSE BIT028 N-sec @ 117 N/cm² INLET P, 238 °C CATALYST BED TEMP.
(.0064 lbf-sec @ 170 PSIA, 460 °F CATALYST BED TEMP)

IMPULSE BIT REPEATABILITY @ 117 N/cm² (170 PSIA) INLET PRESSURE:
3σ REPEATABILITY PULSE NUMBER
± 16 %
± %
± %

CENTROID LOCATION REPEATABILITY FOR _____ sec VALVE ON-TIME:
3σ REPEATABILITY PULSE NUMBER
± %
± %
± %

CHAMBER PRESSURE ROUGHNESS ± %

RESPONSE -
TIME FROM VALVE-ON SIGNAL TO 90% STEADY STATE P_c: _____ sec
TIME FROM VALVE-OFF SIGNAL TO 10% STEADY STATE P_c: _____ sec

STEADY STATE VACUUM SPECIFIC IMPULSE 2206 N-sec/kg (225 lbf-sec/lbm)

LIFE -
TOTAL IMPULSE 71, 171 N-sec (16,000 lbf-sec)
TOTAL THROUGHPUT 48.5 kg (107 lbm)
TOTAL NUMBER OF COLD STARTS 960 @ 93 °C (200 °F)
TOTAL NUMBER OF PULSES..... 1,000,000

STEADY STATE DUTY CYCLE -
TOTAL ON-TIME 2400 sec
MAXIMUM ON-TIME 60 sec

PULSE MODE DUTY CYCLE -
TEMPERATURE AT START OF PULSE TRAIN 93 °C (200 °F)
NOMINAL PULSE TRAIN LENGTH Variable PULSES
NOMINAL ON-TIME(S) 0.15 sec
NOMINAL OFF-TIME(S) Variable sec

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE continued

P/N SV748562

LAUNCH ENVIRONMENT -

RANDOM VIBRATION -

WIDE BAND LEVEL 13.9

G_{rms}

MAX POWER SPECTRAL DENSITY

1.0

G^2/Hz from 20 to 25 Hz narrow band
sweep imposed on $0.1 G^2/Hz$

SINUSOIDAL VIBRATION -

SWEEP RATE

3

OCTAVES/min

MAX G LEVEL (O-PEAK)

.5 in

AT 5-14 Hz

5 G's

AT 14-400 Hz

7.5 G's

AT 400-2000 Hz

ACOUSTIC VIBRATION -

OVERALL SOUND PRESSURE LEVEL

_____ dB FOR _____ MINUTES

SHOCK RESPONSE -

WAVE FORM PEAK-LEVEL OF

40

$G's$ FOR 8 in sec

SHOCK SPECTRUM-PEAK RESPONSE OF

_____ $G's$ AT _____ Hz

AMPLIFICATION FACTOR (Q)

STATIC ACCELERATION

6.0

$G's$

INJECTOR -

PATTERN OF PROPELLANT DISTRIBUTION

Single element, penetrating injector

INJECTOR PRESSURE DROP AT FLOW RATE

214

N/cm^2 @

.00086

kg/sec

(49

PSID @

.0019

lbm/sec)

CATALYST -

TYPE

Shell 405 ABSG

PELLET SIZE(S)

30-35, 20-30

RETENTION TECHNIQUE

Midscreen and end retainer

BED DIAMETER

1.27

cm

(0.50

in)

BED LENGTH

1.48

cm

(0.584

in)

BED LOADING

.0006-.0008

kg/sec/cm²

(.008-.011

lbm/sec/in²)

HEATER -

NOMINAL SUPPLY VOLTAGE

24.5

Vdc,

MAXIMUM POWER

1.4

WATTS @

29.5

Vdc, _____ °C (_____ °F)

CATALYST BED TEMPERATURE

93

°C

(200

°F)

VALVE -

THRUSTER-VALVE INTERFACE DESCRIPTION

Welded

PROOF PRESSURE

552

N/cm^2

(800

PSIA)

BURST PRESSURE

827

N/cm^2

(1200

PSIA)

EXTERNAL LEAKAGE

1×10^{-6}

cc/s OF He

@ 207

± 7

N/cm^2

(300

± 10

PSIA)

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

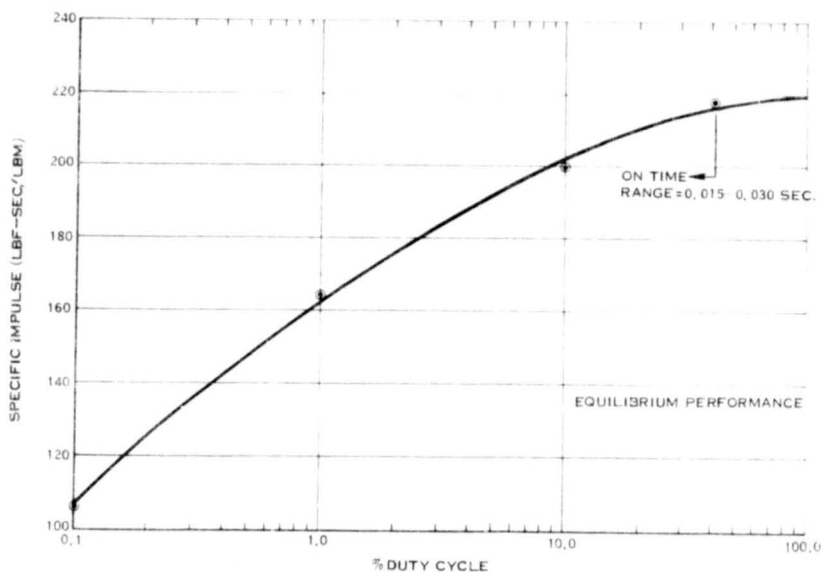
4.3.1 THRUSTER, HYDRAZINE continued

MATERIAL -

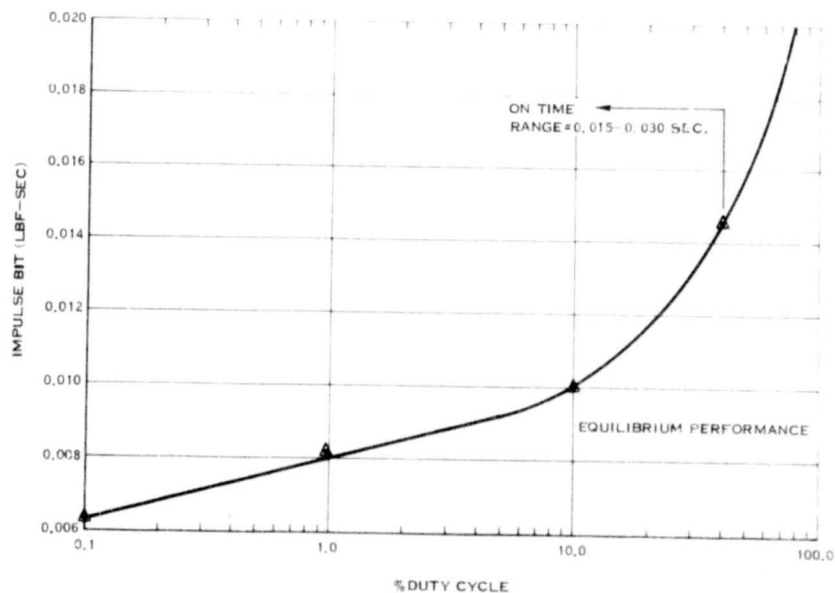
CHAMBER	<u>Inconel 625</u>
STANDOFF	<u>Inconel 625</u>
CATALYST RETAINER	<u>L-605 (Haynes 25)</u>

MASS -

WITH VALVE	<u>0.18</u> kg	(<u>0.40</u> lbm)
WITHOUT VALVE	_____ kg	(_____ lbm)
OTHER	_____ kg	(_____ lbm)



P-50 LOW-MODE PERFORMANCE SPECIFIC IMPULSE (LBS-SEC/LBM)
VS % DUTY CYCLE ($P_{IN}=170$ P.S.I.A.)



P-50 LOW-MODE PERFORMANCE IMPULSE BIT (LBF-SEC)
VS % DUTY CYCLE ($P_{IN}=170$ P.S.I.A.)

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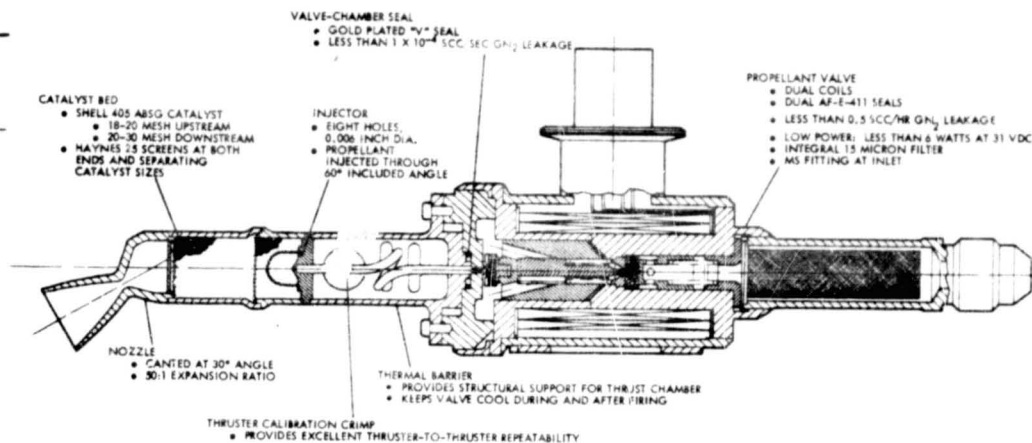
ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE

MANUFACTURER TRW Systems Group (28)

MODEL NO. MRE-1-C

PART NUMBER 410618



VALVE MANUFACTURER.....	<u>Allen Design or Parker Hannifin</u>	PART NUMBER <u>TRW P/NC-401615</u>
HEATER MANUFACTURER.....	_____	PART NUMBER _____
SENSOR MANUFACTURERS.....	_____	PART NUMBER _____
TEMPERATURE TRANSDUCER	_____	PART NUMBER _____
PRESSURE TRANSDUCER	_____	PART NUMBER _____
PROGRAM.....	<u>PIONEER 10 and 11, FLTSATCOM</u>	
CONTRACTING AGENCY	<u>NASA, SAMSO</u>	
PRIME CONTRACTOR	<u>TRW Systems</u>	
STATUS		
QUALIFIED	<u>for PIONEER in 1971; being requalified for</u>	
FLOWN	<u>PIONEER 10 launched in Mar. 1972, FLTSATCOM</u>	
LAUNCH VEHICLE	<u>11 in Apr. 1973</u>	
	<u>ATLAS CENTAUR</u>	
AVAILABILITY	<u>8 months ARO</u>	
COST/PROCUREMENT INFORMATION...	_____	

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER. HYDRAZINE

PROPELLANT..... MIL-P-26536C, Hydrazine

VACUUM THRUST RANGE 5.34-2.0 N (1.2-0.45 lbf)

INLET PRESSURE RANGE 386-96.5 N/cm² (560-140 PSIA)

INLET TEMPERATURE RANGE 5 to 60 °C (40 to 140 °F)

MINIMUM IMPULSE BIT 0.142 N-sec @ 207 N/cm² INLET P, 193 °C CATALYST BED TEMP.
(.032 lbf-sec @ 300 PSIA, 380 °F CATALYST BED TEMP)

IMPULSE BIT REPEATABILITY @ 207 N/cm² (300 PSIA) INLET PRESSURE:
3σ REPEATABILITY PULSE NUMBER
± 5 % 10 and subsequent
± %
± %

CENTROID LOCATION REPEATABILITY FOR .260 sec VALVE ON-TIME: (at 1 CPS)
3σ REPEATABILITY PULSE NUMBER
± 5 % after pulse 5
± %
± %

CHAMBER PRESSURE ROUGHNESS ± 15 %

RESPONSE -
TIME FROM VALVE-ON SIGNAL TO 90% STEADY STATE P_c: 0.035 sec
TIME FROM VALVE-OFF SIGNAL TO 10% STEADY STATE P_c: 0.065 sec

STEADY STATE VACUUM SPECIFIC IMPULSE 2107 N-sec/kg (215^{+ 5%} lbf-sec/lbm)

LIFE -
TOTAL IMPULSE 75,600 N-sec (17,000 lbf-sec)
TOTAL THROUGHPUT 36.3 kg (80 lbm)
TOTAL NUMBER OF COLD STARTS 2100 @ 193 °C (380 °F)
TOTAL NUMBER OF PULSES..... 110,000

STEADY STATE DUTY CYCLE -
TOTAL ON-TIME 18,000 sec
MAXIMUM ON-TIME 10,000 sec

PULSE MODE DUTY CYCLE -
TEMPERATURE AT START OF PULSE TRAIN 193 °C (380 °F)
NOMINAL PULSE TRAIN LENGTH None PULSES (no duty cycle constraint)
NOMINAL ON-TIME(S) sec MRE-1 has been tested over
NOMINAL OFF-TIME(S) sec duty cycles ranging from
0-100% with firing ranging
from 0.015 sec to 10,000 sec
steady states.

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE continued

F/L 410618

LAUNCH ENVIRONMENT -

RANDOM VIBRATION -

WIDE BAND LEVEL G_{rms}
 MAX POWER SPECTRAL DENSITY G^2/Hz from _____ to _____ Hz

SINUSOIDAL VIBRATION -

SWEEP RATE OCTAVES/min
 MAX G LEVEL (0-PEAK) AT _____ Hz
 AT _____ Hz
 AT _____ Hz

ACOUSTIC VIBRATION -

OVERALL SOUND PRESSURE LEVEL dB FOR _____ MINUTES

SHOCK RESPONSE -

WAVE FORM PEAK-LEVEL OF G's FOR _____ sec
 SHOCK SPECTRUM-PEAK RESPONSE OF G's AT _____ Hz
 AMPLIFICATION FACTOR (Q)

STATIC ACCELERATION G's

INJECTOR -

Discrete spray, 8-0.006 holes, 60° included angle

PATTERN OF PROPELLANT DISTRIBUTION
 INJECTOR PRESSURE DROP AT FLOW RATE 101.3 N/cm^2 @ 0.0018 kg/sec
 (147 PSID @ 0.004 lbm/sec)

CATALYST -

TYPE Shell 405 ABSG
 PELLET SIZE(S) 18-20 mesh at Injector End; 20-30 mesh
 RETENTION TECHNIQUE Screens Downstream
 BED DIAMETER 1.13 cm (0.444 in)
 BED LENGTH 2.29 cm (0.9 in)
 BED LOADING $0.0021 \text{ kg/sec/cm}^2$ ($0.03 \text{ lbm/sec/in}^2$)
 (at 1.0 lb thrust)

HEATER - Pioneer used Radioisotope Heaters; Following data are for FLTSATCOM

NOMINAL SUPPLY VOLTAGE 15 Vdc,
 MAXIMUM POWER 2 WATTS @ 15 Vdc, 193 °C (380 °F)
 CATALYST BED TEMPERATURE 193 °C (380 °F)

VALVE -

THRUSTER-VALVE INTERFACE DESCRIPTION Flange, Gold "V" Seal, Mechanical Joint

PROOF PRESSURE 689.6 N/cm^2 (1000 PSIA)

BURST PRESSURE 1072 N/cm^2 (1555 PSIA)

EXTERNAL LEAKAGE $1 \times 10^{-4} \text{ scc/s OF GN}_2$ @ 241 N/cm^2 (350 PSIA)

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE continued

MATERIAL -

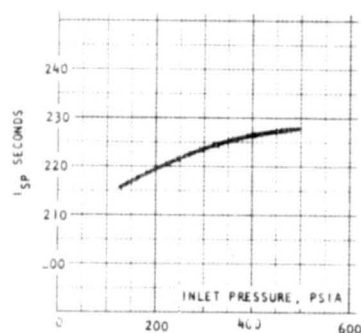
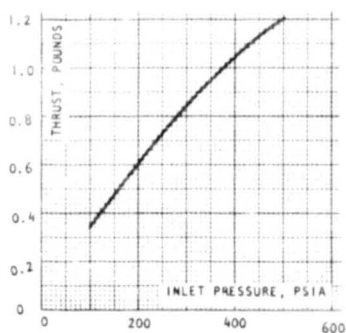
CHAMBER	L-605
STANDOFF	L-605
CATALYST RETAINER	L-605

MASS -

WITH VALVE	_____	kg	(_____ lbm)
WITHOUT VALVE	_____	kg	(_____ lbm)
OTHER .....with heaters.....	0.32	kg	(0.7 lbm)

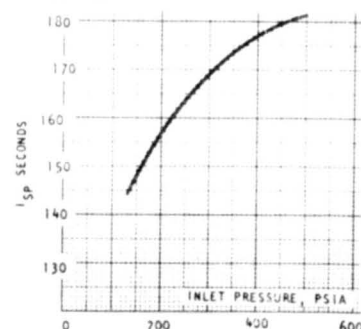
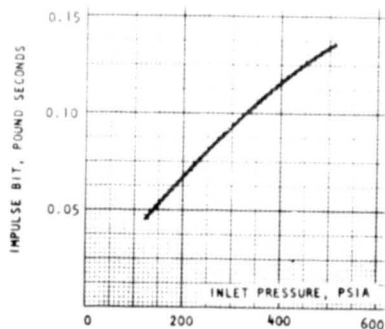
OTHER SIGNIFICANT CHARACTERISTICS

STEADY STATE



PULSING

.125 sec. on/.375 sec. off



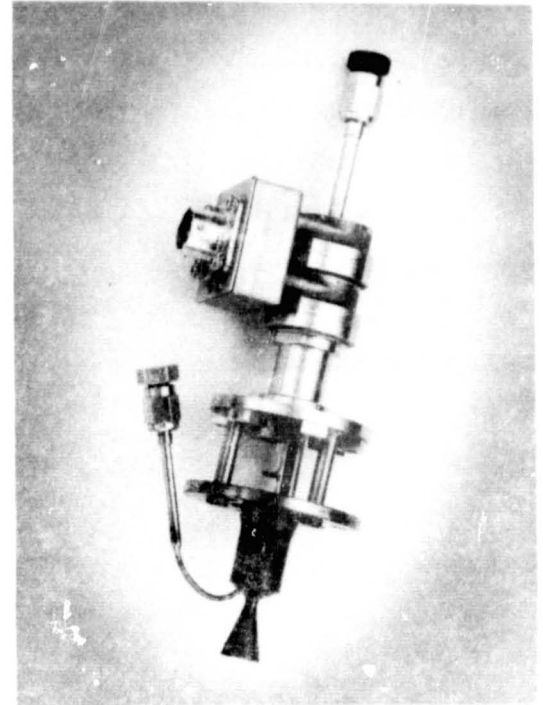
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ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE

MANUFACTURER Rocket Research Corp. (22)

PART NUMBER MR-6C



VALVE MANUFACTURER.....	<u>Parker Hannifin</u>	PART NUMBER <u>5710062</u>
		<u>RRC 26532</u>
HEATER MANUFACTURER.....	<u>Clayborne Labs</u>	PART NUMBER <u>Thrust Chamber</u>
SENSOR MANUFACTURERS.....		
TEMPERATURE TRANSDUCER	<u>N/A</u>	PART NUMBER _____
PRESSURE TRANSDUCER	_____	PART NUMBER _____
PROGRAM.....	<u>SMS, Meteosat</u>	
CONTRACTING AGENCY	<u>NASA</u>	
PRIME CONTRACTOR	<u>Philco-Ford, Marconi (England)</u>	
STATUS		
QUALIFIED	<u>Yes</u>	
FLOWN	<u>Yes (SMS), No (Meteosat)</u>	
LAUNCH VEHICLE	<u>Thor-Delta</u>	
AVAILABILITY	_____	
COST/PROCUREMENT INFORMATION...	_____	

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE

PROPELLANT.....	<u>N₂H₄</u>	
VACUUM THRUST RANGE	<u>2</u> N	(<u>0.5</u> lbf)
INLET PRESSURE RANGE	<u>182.5</u> N/cm ²	(<u>264.7</u> PSIA)
INLET TEMPERATURE RANGE	<u>+10 to 37.7</u> °C	(<u>50 to 100</u> °F)
MINIMUM IMPULSE BIT	<u>N/A</u> N-sec @ <u> </u> N/cm ² INLET P, <u> </u> °C CATALYST BED TEMP.	
Rotational Impulse	(<u> </u> lbf-sec @ <u> </u> PSIA, <u> </u> °F CATALYST BED TEMP)	
IMPULSE BIT @	<u>172,124</u> N/cm ²	(<u>250</u> , <u>180</u> PSIA) INLET PRESSURE:
		<u>180</u> PULSE NUMBER
(first 8000 pulses)	<u>10</u> %	<u>Trains of 5-30 pulses</u>
(over 8000 pulses)	<u>12</u> %	<u> </u>
	<u> </u> %	<u> </u>
CENTROID LOCATION REPEATABILITY FOR <u>0.05</u> sec VALVE ON-TIME:		
C P _f = 250 or 180 psia	3σ REPEATABILITY	PULSE NUMBER
C P _f = 70 psia	<u>12</u> %	<u>Any 30 pulse group at</u>
	<u>30</u> %	<u>a given point in life</u>
	<u> </u> %	<u> </u>
CHAMBER PRESSURE ROUGHNESS	<u> </u> %	<u> </u>
RESPONSE -		
TIME FROM VALVE-ON SIGNAL TO 90% STEADY STATE P _c :	<u>29</u> x 10 ⁻³ sec	
TIME FROM VALVE-OFF SIGNAL TO 10% STEADY STATE P _c :	<u>76</u> x 10 ⁻³ sec	
STEADY STATE VACUUM SPECIFIC IMPULSE	<u> </u> N-sec/kg	(<u>224</u> lbf-sec/lbm)
LIFE -		
TOTAL IMPULSE	<u>1.459</u> x 10 ⁴ N-sec	(<u>3282</u> lbf-sec)
TOTAL THROUGHPUT	<u>6.8</u> kg	(<u>15</u> lbm)
TOTAL NUMBER OF COLD STARTS	<u>15</u> @ <u> </u> °C	(<u>< 100</u> °F)
TOTAL NUMBER OF PULSES.....	<u>100,000</u>	
STEADY STATE DUTY CYCLE -		
TOTAL ON-TIME	<u>511</u> sec	<u>43,106</u> sec demonstrated on ERTS
MAXIMUM ON-TIME	<u>45</u> sec	<u>28,800</u> sec demonstrated on ERTS
PULSE MODE DUTY CYCLE -		
TEMPERATURE AT START OF PULSE TRAIN	<u>+10 to 37.7</u> °C	(<u>50 to 100</u> °F)
NOMINAL PULSE TRAIN LENGTH	<u>30</u> PULSES	
NOMINAL ON-TIME(S)	<u>0.05</u> sec	
NOMINAL OFF-TIME(S)	<u>0.55</u> sec	

4.3.1 THRUSTER, HYDRAZINE continued

LAUNCH ENVIRONMENT -

RANDOM VIBRATION -

WIDE BAND LEVEL $\frac{11.8}{18} G_{rms}$
 MAX POWER SPECTRAL DENSITY $\frac{18}{18} G^2/Hz$ from 40 to 300 Hz

SINUSOIDAL VIBRATION -

SWEEP RATE	<u>4</u>	OCTAVES/min
MAX G LEVEL (0-PEAK)	<u>14.0 g</u>	AT <u>10-30</u> Hz
	<u>12.5 g</u>	AT <u>23-30</u> Hz
	<u>25 g</u>	AT <u>30-60</u> Hz

ACoustic VIBRATION -

OVERALL SOUND PRESSURE LEVEL 144 dB FOR _____ MINUTES (HPM Qualification)

SHOCK RESPONSE -

WAVE FORM PEAK-LEVEL OF 30 G's FOR 8 m sec (HPM Dev. Test)

SHOCK SPECTRUM-PEAK RESPONSE OF 30 G's AT Hz

AMPLIFICATION FACTOR (Q)

STATIC ACCELERATION 17.5 G's

INJECTOR -

PATTERN OF PROPELLANT DISTRIBUTION Single Speed

INJECTOR PRESSURE DROP AT FLOW RATE N/cm^2 @ kg/sec
(..... PSID @ lbm/sec)

CATALYST -

TYPE Shell 405

PELLET SIZE(S) 25-30 Mesh

RETENTION TECHNIQUE Screens and Bed Plates

BED DIAMETER 1.26 cm (0.498 in)

BED LENGTH 1.99 cm (0.785 in)

BED LOADING kg/sec/cm² (0.00115 lbm/sec/in²)

HEATER -

NOMINAL SUPPLY VOLTAGE 27.5 Vdc.

MAXIMUM POWER * WATTS @ 29 V_{dc}, _____ °C (90.5 °F)

CATALYST BED TEMPERATURE °C (195 °F)

VALVE -

*1.3 Watt Maximum for catalyst bed

THRUSTER-VALVE INTERFACE DESCRIPTION Bolted

PROOF PRESSURE N/cm² (PSIA)

BURST PRESSURE 7860.0 N/cm² (11,400 PSIA)

EXTERNAL LEAKAGE $\frac{10^{-6}}{\text{Valve only}}$ scc/s OF He @ $\frac{217}{\text{N/cm}^2}$ ($\frac{315}{\text{PSIA}}$)

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE continued

MATERIAL -

CHAMBER 347 Stainless Steel
STANDOFF Hastelloy C
CATALYST RETAINER 347 Stainless Steel

MASS -

WITH VALVE 0.29 kg (0.65 lbm)
WITHOUT VALVE kg (lbm)
OTHER kg (lbm)

OTHER SIGNIFICANT CHARACTERISTICS

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE

MANUFACTURER TRW Systems (28)

PART NUMBER MRE-4-A-1
MRE-4-C-3
MRE-4-C1-2
MRE-4-C2-2
MRE-4-C-4

VALVE MANUFACTURER..... Parker Hannifin PART NUMBER C-401023
 HEATER MANUFACTURER..... N/A PART NUMBER _____
 SENSOR MANUFACTURERS.....
 TEMPERATURE TRANSDUCER PART NUMBER _____
 PRESSURE TRANSDUCER PART NUMBER _____
 PROGRAM..... INTELSAT III
 CONTRACTING AGENCY COMSAT, SAMSO, NASA
 PRIME CONTRACTOR TRW, RCA
 STATUS
 QUALIFIED Yes
 FLOWN 20 on INTELSAT III; 20 on DSCS II; 3 on
 LAUNCH VEHICLE THOR DELTA, TITAN III C ^{Atmosphere Explorer}
 AVAILABILITY 8 months ARO
 COST/PROCUREMENT INFORMATION... _____

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE

PROPELLANT..... MIL-P-26536C, Hydrazine

VACUUM THRUST RANGE 18.2-3.1 N (4.1-0.7 lbf)

INLET PRESSURE RANGE 408.1-34.0 N/cm² (600-50 PSIA)

INLET TEMPERATURE RANGE 5 to 66 °C (40 to 150 °F)

MINIMUM IMPULSE BIT 0.85 N-sec @ 408.1 N/cm² INLET P, 13 °C CATALYST BED TEMP.
(0.19 lbf-sec @ 600 PSIA, 55 °F CATALYST BED TEMP)

IMPULSE BIT REPEATABILITY @ 408.1 N/cm² (600 PSIA) INLET PRESSURE:
3σ REPEATABILITY PULSE NUMBER

<u>± 25</u> %	<u>5</u>
<u>± 18</u> %	<u>10</u>
<u>± 10</u> %	<u>20</u>

CENTROID LOCATION REPEATABILITY FOR .117 sec VALVE ON-TIME: @ Inlet Pressure 600 psia
3σ REPEATABILITY PULSE NUMBER

<u>± 10</u> %	<u>After pulse No. 5</u>
<u>±</u> %	
<u>±</u> %	

CHAMBER PRESSURE ROUGHNESS ± 15 %

RESPONSE -

TIME FROM VALVE-ON SIGNAL TO 90% STEADY STATE P_C: 0.040 sec

TIME FROM VALVE-OFF SIGNAL TO 10% STEADY STATE P_C: 0.050 sec

STEADY STATE VACUUM SPECIFIC IMPULSE 2254 ± 2% N-sec/kg (230 ± 2% lbf-sec/lbm)

LIFE -

TOTAL IMPULSE 511,500 N-sec (115,000 lbf-sec)

TOTAL THROUGHPUT 227 kg (500 lbm)

TOTAL NUMBER OF COLD STARTS 177 @ 5 to 52 °C (40 to 125 °F)

TOTAL NUMBER OF PULSES..... 101,944

STEADY STATE DUTY CYCLE -

TOTAL ON-TIME 36,610 sec

MAXIMUM ON-TIME 7080 sec

PULSE MODE DUTY CYCLE -

TEMPERATURE AT START OF PULSE TRAIN 5 to 66 °C (40 to 150 °F)

NOMINAL PULSE TRAIN LENGTH 315 PULSES

NOMINAL ON-TIME(S) 0.117 sec

NOMINAL OFF-TIME(S) 0.883 sec

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE continued

P/N MRE-4-A-1

LAUNCH ENVIRONMENT -

RANDOM VIBRATION -

WIDE BAND LEVEL G_{rms}
 MAX POWER SPECTRAL DENSITY G^2/Hz from _____ to _____ Hz

SINUSOIDAL VIBRATION -

SWEEP RATE OCTAVES/min
 MAX G LEVEL (O-PEAK) AT _____ Hz
 AT _____ Hz
 AT _____ Hz

ACOUSTIC VIBRATION -

OVERALL SOUND PRESSURE LEVEL dB FOR _____ MINUTES

SHOCK RESPONSE -

WAVE FORM PEAK-LEVEL OF G's FOR _____ sec
 SHOCK SPECTRUM-PEAK RESPONSE OF G's AT _____ Hz
 AMPLIFICATION FACTOR (Q)

STATIC ACCELERATION G's

INJECTOR -

PATTERN OF PROPELLANT DISTRIBUTION

Discrete Spray, 13-0.0065 orifices,
 35° included angle

INJECTOR PRESSURE DROP AT FLOW RATE

32.0-40.1 N/cm² @ 0.0068 kg/sec
 (180 PSID @ 0.015 lbm/sec)

CATALYST -

TYPE

Shell 405 ABSG

PELLET SIZE(S)

14-18 mesh @ Injector 20-30 mesh Down Stream
 Compartment

RETENTION TECHNIQUE

Screens-Single @ Injector & For Separating
 Catalyst Double at Nozzle End

BED DIAMETER

1.9 cm (0.75 in)

BED LENGTH

2.7 cm (1.06 in)

BED LOADING

0.0028 kg/sec/cm² (0.04 lbm/sec/in²)

HEATER -

NOMINAL SUPPLY VOLTAGE

N/A Vdc,

MAXIMUM POWER

_____ WATTS @ _____ Vdc, _____ °C (_____ °F)

CATALYST BED TEMPERATURE ...

_____ °C (_____ °F)

VALVE -

THRUSTER-VALVE INTERFACE DESCRIPTION

Flange-Joint, Gold-Plate V Seal

PROOF PRESSURE

680.7 N/cm² (1000 PSIA)

BURST PRESSURE

816.2 N/cm² (1200 PSIA)

EXTERNAL LEAKAGE

1 x 10⁻⁴ scc/s OF GN² @ 408.1 N/cm² (600 PSIA)

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE continued

MATERIAL -

CHAMBER Haynes 25
 STANDOFF Haynes 25
 CATALYST RETAINER Haynes 25

MASS -

WITH VALVE kg (..... lbm)
 WITHOUT VALVE kg (..... lbm)
 OTHER 0.27 kg (0.6 lbm)

OTHER SIGNIFICANT CHARACTERISTICS

QUALIFICATION STATUS OF MRE-4 ENGINE

MODEL	PROGRAM	TOTAL PULSES	COLD STARTS (40° - 125°F)	TOTAL STEADY STATE BURN TIME (SEC.)	LONGEST SINGLE BURN (SEC.)	TOTAL IMPULSE (LB-SEC.)
MRE-4-A-1	INTELSAT III					
	QUAL #1 (Axial)	4,920	162	6,780	314	9,000
	QUAL #2 (Radial)	11,080	129	300	30	1,000
MRE-4-C-3	A.F. PROGRAM					
	QUAL #1	104,246	194	N.R.**	N.R.	34,000
	QUAL #2	96,477	181	N.R.	N.R.	30,000
MRE-4-C1-2	DSCS II					
MRE-4-C2-2	QUAL #1	43,200	N.R.	N.R.	N.R.	17,820
	QUAL #2	23,067	N.R.	N.R.	N.R.	22,600
MRE-4-C-4	A/E OAPS					
	DVT (Development)	5552	25*	32,610	7080	115,000
MRE-4-A-1	AFRPL DEMONSTRATION TEST	507,000	N.R. (20)	400	60	40,000
			*4°-95°F	**NR-Not Required		

MRE-4 ENGINE

(0.7—4.1 lb thrust)

P/N MRE-4-A-1

PROPELLANT VALVE

- DUAL COIL
- DUAL SEAT
- EPT RUBBER SEALS
- LESS THAN 0.5 SCC/HR GN_2 LEAKAGE
- LOW POWER: LESS THAN 6 WATTS AT 31 VDC
- INTEGRAL 75 MICRON (ABSOLUTE) FILTER
- MS FITTING AT INLET

VALVE-CHAMBER SEAL

- GOLD PLATED "V" SEAL
- LESS THAN 1×10^{-4} SCC/HR GN_2 LEAKAGE

CATALYST

- SHELL 40S AB5G
- 14 - 18 MESH (LARGER SIZE) AT INJECTOR END
- 20 - 30 MESH (SMALLER SIZE) AT NOZZLE END

NOZZLE

- CAST OR MACHINED
- STRAIGHT OR CANTED

THERMAL BARRIER

- PROVIDES STRUCTURAL SUPPORT FOR THRUST CHAMBER
- MAINTAINS VALVE BELOW 150°F DURING AND AFTER FIRING

REA CALIBRATION CRIMP

- PROVIDES EXCELLENT ENGINE-TO-ENGINE REPEATABILITY

SCREENS

- HAYNES 25
- SINGLE SCREEN AT INJECTOR PROVIDES HEADSPACE
- SINGLE SCREEN SEPARATES 2 SIZES OF CATALYST
- DOUBLE SCREEN RETAINS CATALYST IN ENGINE

THERMAL CONTROL ELEMENTS

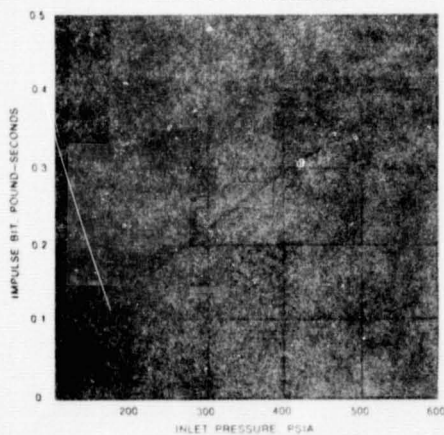
(DEPENDENT ON SPACECRAFT INSTALLATION AND USE)

- VALVE HEATER
 - PATCH HEATER BONDED TO VALVE BODY, PREVENTS PROPELLANT FREEZING
- CATALYST BED HEATER
 - SHEATH HEATER BONDED TO THRUST CHAMBER, MINIMIZES COLD STARTS (BELOW 40°F)
- INSULATION
 - CERAMIC COAT/PT-MOLYBDENUM FOIL WRAPPED AROUND THRUST CHAMBER HELPS TO RETAIN ENGINE HEAT AND PROTECT SURROUNDING SPACECRAFT STRUCTURE

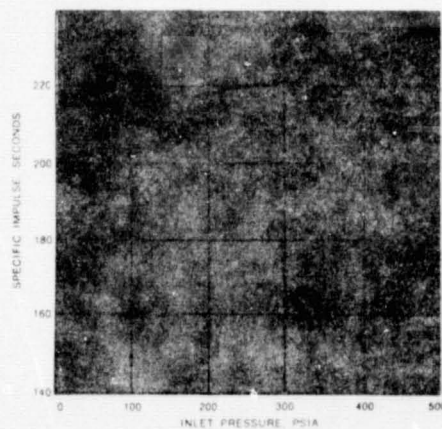
INJECTOR

- 13 HOLES, 0.0063 INCH DIAMETER
- PROPELLANT INJECTED THROUGH 35° INCLUDED ANGLE

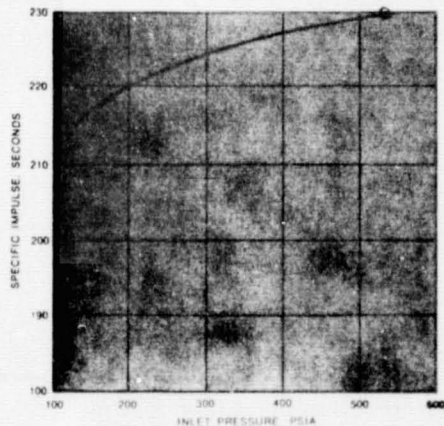
TYPICAL PULSING PERFORMANCE



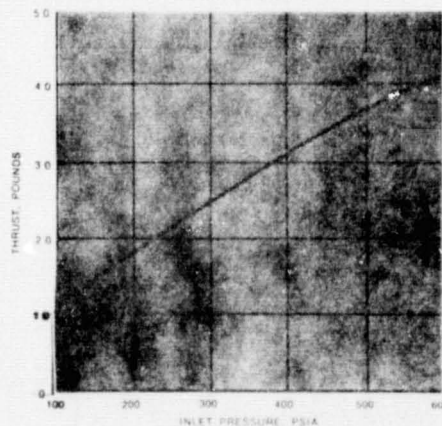
TYPICAL PULSING PERFORMANCE



NOMINAL STEADY STATE SPECIFIC IMPULSE



NOMINAL STEADY STATE THRUST



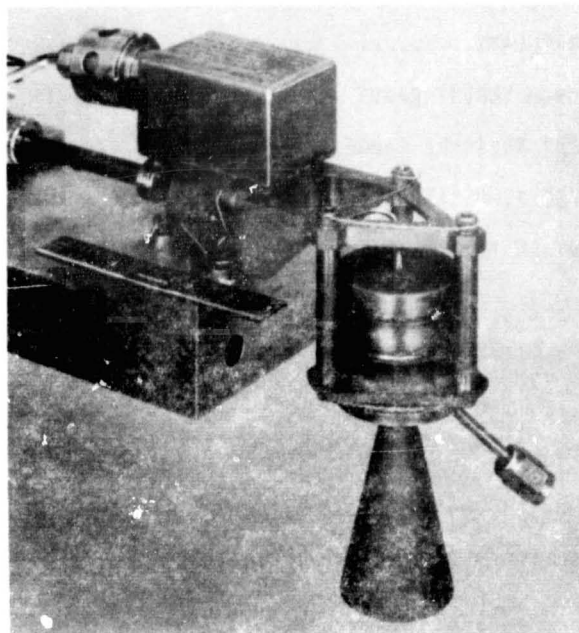
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ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE

MANUFACTURER Hughes Aircraft Co. (52)

PART NUMBER 3354474



VALVE MANUFACTURER..... PART NUMBER _____

HEATER MANUFACTURER..... PART NUMBER _____

SENSOR MANUFACTURERS.....

TEMPERATURE TRANSDUCER PART NUMBER _____

PRESSURE TRANSDUCER PART NUMBER _____

PROGRAM..... Intelsat IVA

CONTRACTING AGENCY International Telecommunications
Satellite Corp.

PRIME CONTRACTOR

STATUS

QUALIFIED Yes

FLOWN Scheduled 1975

LAUNCH VEHICLE

AVAILABILITY Approximately 9 months lead time

COST/PROCUREMENT INFORMATION... \$25,000

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4.3.1-49

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE

N₂H₄

PROPELLANT.....
 VACUUM THRUST RANGE 25-6.2 N (5.7-1.4 lbf)
 INLET PRESSURE RANGE 206-34 N/cm² (300-50 PSIA)
 INLET TEMPERATURE RANGE 4.4 to 60.0 °C (40 to 140 °F)
 MINIMUM IMPULSE BIT13 N-sec @ _____ N/cm² INLET P, _____ °C CATALYST BED TEMP.
 (.03 lbf-sec @ _____ PSIA, _____ °F CATALYST BED TEMP)

IMPULSE BIT REPEATABILITY @ N/cm² (_____ PSIA) INLET PRESSURE:
 3σ REPEATABILITY PULSE NUMBER

± _____ %
± _____ %
± _____ %

CENTROID LOCATION REPEATABILITY FOR _____ sec VALVE ON-TIME:

3σ REPEATABILITY PULSE NUMBER

± _____ %
± _____ %
± _____ %

CHAMBER PRESSURE ROUGHNESS 5 %

RESPONSE -

TIME FROM VALVE-ON SIGNAL TO 90% STEADY STATE P_c: 40 m sec

TIME FROM VALVE-OFF SIGNAL TO 10% STEADY STATE P_c: 50 m sec

STEADY STATE VACUUM SPECIFIC IMPULSE N-sec/kg (228 lbf-sec/lbm)

LIFE -

TOTAL IMPULSE 711,680 N-sec (160,000 lbf-sec)

TOTAL THROUGHPUT 324 kg (715 lbm)

TOTAL NUMBER OF COLD STARTS 899 @ 44 °C (6.6 °F)

TOTAL NUMBER OF PULSES..... 55,600

STEADY STATE DUTY CYCLE -

TOTAL ON-TIME 39,177 sec

MAXIMUM ON-TIME 2,000 sec

PULSE MODE DUTY CYCLE -

TEMPERATURE AT START OF PULSE TRAIN 60 °C (15 °F)

NOMINAL PULSE TRAIN LENGTH 15-500 PULSES

NOMINAL ON-TIME(S) 40 & 117 sec

NOMINAL OFF-TIME(S) 1160 & 1083 sec

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE continued

P/N 3354474

LAUNCH ENVIRONMENT -

RANDOM VIBRATION -

WIDE BAND LEVEL G_{rms}
 MAX POWER SPECTRAL DENSITY G^2/Hz from _____ to _____ Hz

SINUSOIDAL VIBRATION -

SWEEP RATE OCTAVES/min
 MAX G LEVEL (0-PEAK) AT _____ Hz
 AT _____ Hz
 AT _____ Hz

ACOUSTIC VIBRATION -

OVERALL SOUND PRESSURE LEVEL dB FOR _____ MINUTES

SHOCK RESPONSE -

WAVE FORM PEAK-LEVEL OF G's FOR _____ sec
 SHOCK SPECTRUM-PEAK RESPONSE OF G's AT _____ Hz
 AMPLIFICATION FACTOR (Q)

STATIC ACCELERATION G's

INJECTOR -

PATTERN OF PROPELLANT DISTRIBUTION Axial & Radial

INJECTOR PRESSURE DROP AT FLOW RATE N/cm^2 @ _____ kg/sec
 (_____ PSID @ _____ lbm/sec)

CATALYST -

TYPE Shell 405, ABSG

PELLET SIZE(S) 14-18 Mesh, 20-30 Mesh

RETENTION TECHNIQUE Screens

BED DIAMETER cm (_____ in)

BED LENGTH cm (_____ in)

BED LOADING $kg/sec/cm^2$ (_____ lbm/sec/in²)

HEATER -

NOMINAL SUPPLY VOLTAGE Vdc,
 MAXIMUM POWER WATTS @ _____ Vdc, _____ °C (_____ °F)
 CATALYST BED TEMPERATURE °C (_____ °F)

VALVE -

THRUSTER-VALVE INTERFACE DESCRIPTION Series redundant, hard seat, torque
 motor operated

PROOF PRESSURE 310 N/cm^2 (450 PSIA)

BURST PRESSURE 413 N/cm^2 (600 PSIA)

EXTERNAL LEAKAGE 0 scc/s OF _____ @ _____ N/cm^2 (300 PSIA)

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE continued

MATERIAL -

CHAMBER Cobalt (L605) & Nickel (Inconel 600)
STANDOFF
CATALYST RETAINER

MASS -

WITH VALVE512 kg (1.13 lbm)
WITHOUT VALVE kg (lbm)
OTHER kg (lbm)

OTHER SIGNIFICANT CHARACTERISTICS

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE

MANUFACTURER Hughes Aircraft Co. (52)

PART NUMBER 3194300

VALVE MANUFACTURER..... PART NUMBER

HEATER MANUFACTURER..... PART NUMBER

SENSOR MANUFACTURERS.....

TEMPERATURE TRANSDUCER PART NUMBER

PRESSURE TRANSDUCER PART NUMBER

PROGRAM..... Intelsat IV

CONTRACTING AGENCY Comsat Corp.

PRIME CONTRACTOR

STATUS

QUALIFIED Completed

FLOWN Yes

LAUNCH VEHICLE

AVAILABILITY 9 months lead time

COST/PROCUREMENT INFORMATION... \$20,000

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE

PROPELLANT..... N₂H₄

VACUUM THRUST RANGE 8.8-23 N (2.0-5.3 lbf)

INLET PRESSURE RANGE 177-62 N/cm² (258-90 PSIA)

INLET TEMPERATURE RANGE 4.4 to 60°C (+40 to 140°F)

MINIMUM IMPULSE BIT 0.2 N-sec @ 189 N/cm² INLET P, _____°C CATALYST BED TEMP.
(0.5 lbf-sec @ 275 PSIA, _____°F CATALYST BED TEMP)

IMPULSE BIT REPEATABILITY @ _____ N/cm² (_____ PSIA) INLET PRESSURE:
3σ REPEATABILITY PULSE NUMBER
± 5 % 50
± % _____
± % _____

CENTROID LOCATION REPEATABILITY FOR 105 m_{sec} VALVE ON-TIME: @ 275 supply pressure
3σ REPEATABILITY PULSE NUMBER
± 11 % 50
± % _____
± % _____

CHAMBER PRESSURE ROUGHNESS ± 5 %

RESPONSE -
TIME FROM VALVE-ON SIGNAL TO 90% STEADY STATE P_c: 40 m sec
TIME FROM VALVE-OFF SIGNAL TO 10% STEADY STATE P_c: 50 m sec

STEADY STATE VACUUM SPECIFIC IMPULSE 2253 N-sec/kg (227 lbf-sec/lbm)

LIFE -
TOTAL IMPULSE 400,320 N-sec (90,000 lbf-sec)
TOTAL THROUGHPUT 226 kg (500 lbm)
TOTAL NUMBER OF COLD STARTS 290 @ -9.4°C (15.6°F)
TOTAL NUMBER OF PULSES..... 8

STEADY STATE DUTY CYCLE -
TOTAL ON-TIME 55,000 sec
MAXIMUM ON-TIME 2940 sec

PULSE MODE DUTY CYCLE -
TEMPERATURE AT START OF PULSE TRAIN 51.7°C (123.9°F)
NOMINAL PULSE TRAIN LENGTH 1500 PULSES
NOMINAL ON-TIME(S) 0.117 sec
NOMINAL OFF-TIME(S) 1.083 sec

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE continued

P/N 3194300

LAUNCH ENVIRONMENT -

RANDOM VIBRATION -

WIDE BAND LEVEL G_{rms}
 MAX POWER SPECTRAL DENSITY G^2/Hz from _____ to _____ Hz

SINUSOIDAL VIBRATION -

SWEEP RATE OCTAVES/min
 MAX G LEVEL (0-PEAK) AT _____ Hz
 AT _____ Hz
 AT _____ Hz

ACOUSTIC VIBRATION -

OVERALL SOUND PRESSURE LEVEL dB FOR _____ MINUTES

SHOCK RESPONSE -

WAVE FORM PEAK-LEVEL OF G's FOR _____ sec
 SHOCK SPECTRUM-PEAK RESPONSE OF G's AT _____ Hz
 AMPLIFICATION FACTOR (Q)

STATIC ACCELERATION G's

INJECTOR -

PATTERN OF PROPELLANT DISTRIBUTION

Axial and radial

INJECTOR PRESSURE DROP AT FLOW RATE

_____ N/cm^2 @ _____ kg/sec
 (_____ PSID @ _____ lbm/sec)

CATALYST -

TYPE

Shell 405, ABSG

PELLET SIZE(S)

14-18, 20-30 mesh

RETENTION TECHNIQUE

Screen covered perforated plates

BED DIAMETER

2.66 cm (1.05 in)

BED LENGTH

3.55 cm (1.40 in)

BED LOADING

_____ $kg/sec/cm^2$ (.0252 lbm/sec/in²)

HEATER -

NOMINAL SUPPLY VOLTAGE

_____ Vdc,

MAXIMUM POWER

_____ WATTS @ _____ Vdc, _____ °C (_____ °F)

CATALYST BED TEMPERATURE

_____ °C (_____ °F)

VALVE -

THRUSTER-VALVE INTERFACE DESCRIPTION

Series redundant, hard seat,
torque motor operated

PROOF PRESSURE

310 N/cm^2 (450 PSIA)

BURST PRESSURE

1034 N/cm^2 (>1500 PSIA)

EXTERNAL LEAKAGE

0 scc/s OF GN_2 @ 206 N/cm^2 (300 PSIA)

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE continued

MATERIAL -

CHAMBER Cobalt (L605) and Nockel (Incone1 600)
STANDOFF
CATALYST RETAINER

MASS -

WITH VALVE494 kg (1.08 lbm)
WITHOUT VALVE kg (lbm)
OTHER valve only2766 kg (.6099 lbm)

OTHER SIGNIFICANT CHARACTERISTICS

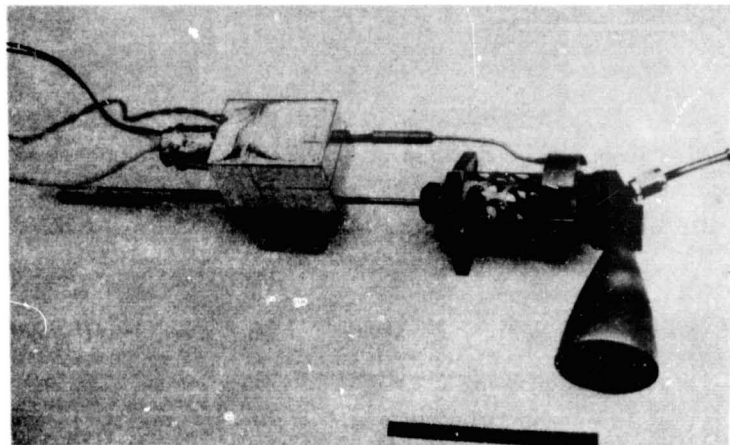
ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE

MANUFACTURER Hamilton Standard Div. (32)

MODEL NO. REA 16-10

PART NUMBER SV 755446



VALVE MANUFACTURER.....	<u>HR&M</u>	PART NUMBER <u>4800 2260</u>
HEATER MANUFACTURER.....	<u>Tayco</u>	PART NUMBER <u>13-2258</u>
SENSOR MANUFACTURERS.....		
TEMPERATURE TRANSDUCER	<u>N/A</u>	PART NUMBER _____
PRESSURE TRANSDUCER		PART NUMBER _____
PROGRAM.....	<u>NATO III</u>	
CONTRACTING AGENCY	_____	
PRIME CONTRACTOR	<u>Philco-Ford</u>	
STATUS		
QUALIFIED	_____	
FLOWN	<u>Yes</u>	
LAUNCH VEHICLE	_____	
AVAILABILITY	<u>Production status</u>	
COST/PROCUREMENT INFORMATION...	_____	

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE

PROPELLANT..... N₂H₄

VACUUM THRUST RANGE 10.7-24.5 N (2.4-5.5 lbf)

INLET PRESSURE RANGE 69-207 N/cm² (100-300 PSIA)

INLET TEMPERATURE RANGE 4-60 °C (40-140 °F)

MINIMUM IMPULSE BIT _____ N-sec @ _____ N/cm² INLET P, _____ °C CATALYST BED TEMP.
(_____ lbf-sec @ _____ PSIA, _____ °F CATALYST BED TEMP)

IMPULSE BIT REPEATABILITY @ 207 N/cm² (300 PSIA) INLET PRESSURE:
3σ REPEATABILITY PULSE NUMBER

± <u>6.1</u> %	<u>1-10</u>
± <u>5.5</u> %	<u>1-50</u>
± <u>5.3</u> %	<u>1-100</u>

CENTROID LOCATION REPEATABILITY FOR 100 sec VALVE ON-TIME:
3σ REPEATABILITY PULSE NUMBER

± <u>6.2</u> %	<u>51-100</u>
± _____ %	_____
± _____ %	_____

CHAMBER PRESSURE ROUGHNESS _____

RESPONSE -

TIME FROM VALVE-ON SIGNAL TO 90% STEADY STATE P_c: .030 sec

TIME FROM VALVE-OFF SIGNAL TO 10% STEADY STATE P_c: .035 sec

STEADY STATE VACUUM SPECIFIC IMPULSE 2304 N-sec/kg (235 lbf-sec/lbm)

LIFE -

TOTAL IMPULSE 120,101 N-sec (27,000 lbf-sec)

TOTAL THROUGHPUT 55 kg (122 lbm)

TOTAL NUMBER OF COLD STARTS 150 @ 38 °C (100 °F)

TOTAL NUMBER OF PULSES..... 60,000

STEADY STATE DUTY CYCLE -

TOTAL ON-TIME 600 sec

MAXIMUM ON-TIME 60 sec

PULSE MODE DUTY CYCLE -

TEMPERATURE AT START OF PULSE TRAIN 38 °C (100 °F)

NOMINAL PULSE TRAIN LENGTH 300 PULSES

NOMINAL ON-TIME(S)100 sec

NOMINAL OFF-TIME(S)650 sec

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE continued

P/N SV 755446

LAUNCH ENVIRONMENT -

RANDOM VIBRATION -

WIDE BAND LEVEL 19.6 G_{rms}
 MAX POWER SPECTRAL DENSITY 0.25 G^2/Hz from 300 to 1200 Hz

SINUSOIDAL VIBRATION -

SWEEP RATE OCTAVES/min
 MAX G LEVEL (0-PEAK) AT Hz
 AT Hz
 AT Hz

ACOUSTIC VIBRATION -

OVERALL SOUND PRESSURE LEVEL dB FOR MINUTES

SHOCK RESPONSE -

WAVE FORM PEAK-LEVEL OF G's FOR sec
 SHOCK SPECTRUM-PEAK RESPONSE OF G's AT Hz
 AMPLIFICATION FACTOR (Q)

STATIC ACCELERATION 20 G's

INJECTOR -

PATTERN OF PROPELLANT DISTRIBUTION Multi-element, penetrating injector

INJECTOR PRESSURE DROP AT FLOW RATE 69 H/cm^2 @ .0095 kg/sec
 (100 PSID @ .02 lbm/sec)

CATALYST -

TYPE Shell 405 ABSG
 PELLET SIZE(S) 30-35, 14-18
 RETENTION TECHNIQUE Mid Screen and End Retainers
 BED DIAMETER 2.44 cm (.960 in)
 BED LENGTH 1.47 cm (.579 in)
 BED LOADING0010 - .0022 kg/sec/cm² (.015 - .032 lbm/sec/in²)

HEATER -

NOMINAL SUPPLY VOLTAGE 29.4 Vdc,
 MAXIMUM POWER 2.7 WATTS @ 29.4 Vdc, °C (..... °F)
 CATALYST BED TEMPERATURE 38 °C (100 °F)

VALVE -

THRUSTER-VALVE INTERFACE DESCRIPTION Welded

PROOF PRESSURE 462 N/cm^2 (670 PSIA)

BURST PRESSURE 965 N/cm^2 (1400 PSIA)

EXTERNAL LEAKAGE 1 x 10⁻⁶ sec/s OF He @ 207 N/cm^2 (300 PSIA)

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE continued

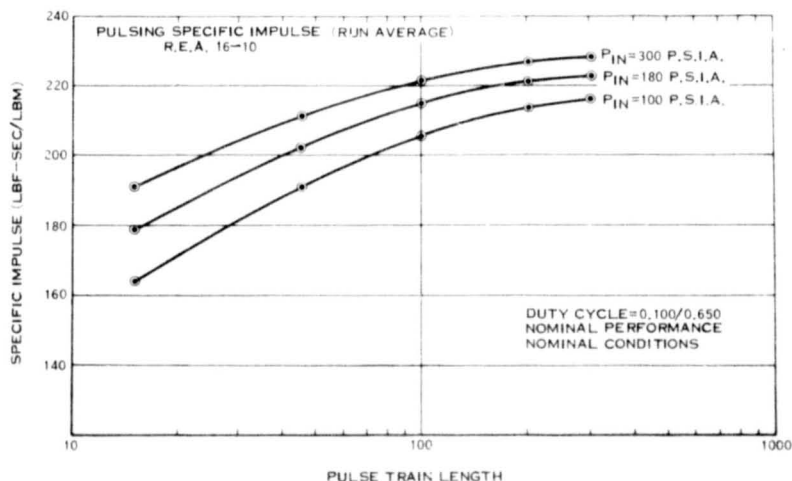
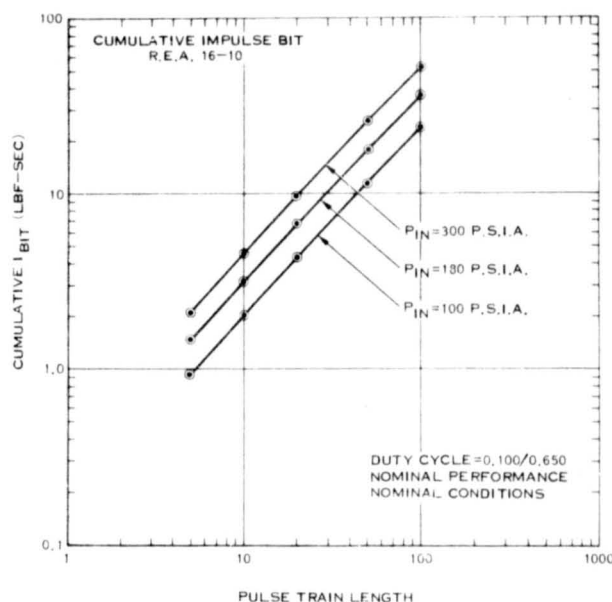
MATERIAL -

CHAMBER Inconel 600 (Inconel 625 Nozzle)
 STANDOFF Inconel 600
 CATALYST RETAINER L-605

MASS -

WITH VALVE50 kg (1.1 lbm)
 WITHOUT VALVE kg (lbm)
 OTHER kg (lbm)

OTHER SIGNIFICANT CHARACTERISTICS



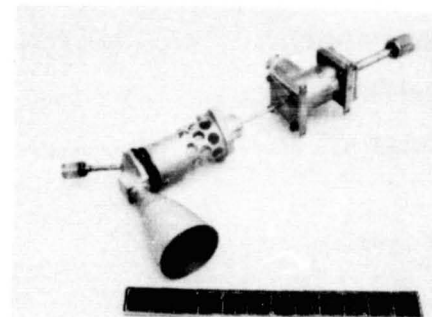
ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE

MANUFACTURER Hamilton Standard (32)

MODEL NO. R.E.A.16-9

PART NUMBER SV755436



VALVE MANUFACTURER..... Wright PART NUMBER 15676-2

HEATER MANUFACTURER..... PART NUMBER _____

SENSOR MANUFACTURERS.....

TEMPERATURE TRANSDUCER PART NUMBER _____

PRESSURE TRANSDUCER PART NUMBER _____

PROGRAM..... Multiple Satellite Dispenser (MSD)

CONTRACTING AGENCY Naval Research Lab

PRIME CONTRACTOR _____

STATUS

QUALIFIED Thruster is of same class that

FLOWN has flown on NATO III

LAUNCH VEHICLE Qualified. Scheduled MSD flight is 1975

AVAILABILITY Production status

COST/PROCUREMENT INFORMATION... _____

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE

N_2H_4

PROPELLANT.....
 VACUUM THRUST RANGE 11.1-22.2 N (2.5-5.0 lbf)
 INLET PRESSURE RANGE 86-172 N/cm² (125-250 PSIA)
 INLET TEMPERATURE RANGE 5 to 50 °C (41 to 122 °F)
 MINIMUM IMPULSE BIT N-sec @ N/cm² INLET P, °C CATALYST BED TEMP.

(lbf-sec @ PSIA, °F CATALYST BED TEMP)

IMPULSE BIT REPEATABILITY @ 172 N/cm² (250 PSIA) INLET PRESSURE:
 3σ REPEATABILITY PULSE NUMBER

Unit-to-unit pulse train average 5.5 % 1-100
 impulse bit repeatability

Pulse-to-pulse 3.0 % 20-100

CENTROID LOCATION REPEATABILITY FOR .670 sec VALVE ON-TIME:

Unit-to-unit pulse train average 1.7 % 1-100
 centroid time repeatability

Pulse-to-pulse 1.1 % 10-100

CHAMBER PRESSURE ROUGHNESS %

RESPONSE -

TIME FROM VALVE-ON SIGNAL TO 90% STEADY STATE P_c : .030 sec

TIME FROM VALVE-OFF SIGNAL TO 10% STEADY STATE P_c : .075 sec

STEADY STATE VACUUM SPECIFIC IMPULSE 232 N-sec/kg (237 lbf-sec/lbm)

LIFE -

TOTAL IMPULSE 501,579 N-sec (112,760 lbf-sec)

TOTAL THROUGHPUT 222 kg (490 lbm)

TOTAL NUMBER OF COLD STARTS 95 @ 32 °C (90 °F)

TOTAL NUMBER OF PULSES..... 16,000

STEADY STATE DUTY CYCLE -

TOTAL ON-TIME 21,600 sec

MAXIMUM ON-TIME 600 sec

PULSE MODE DUTY CYCLE -

TEMPERATURE AT START OF PULSE TRAIN 32 °C (90 °F)

NOMINAL PULSE TRAIN LENGTH 100 PULSES

NOMINAL ON-TIME(S) 0.670 sec

NOMINAL OFF-TIME(S) 1.330 sec

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE continued

P/N SV755436

LAUNCH ENVIRONMENT -

RANDOM VIBRATION -

WIDE BAND LEVEL 6.0 G_{rms}
 MAX POWER SPECTRAL DENSITY 0.1 G^2/Hz from 20 to 200 Hz

SINUSOIDAL VIBRATION -

SWEEP RATE 1.0 OCTAVES/min
11 AT 25-2000 Hz
 MAX G LEVEL (O-PEAK)
 AT Hz
 AT Hz

ACOUSTIC VIBRATION -

OVERALL SOUND PRESSURE LEVEL dB FOR MINUTES

SHOCK RESPONSE -

WAVE FORM PEAK-LEVEL OF G's FOR sec

SHOCK SPECTRUM-PEAK RESPONSE OF G's AT Hz

AMPLIFICATION FACTOR (G)

STATIC ACCELERATION 10 G's

INJECTOR -

PATTERN OF PROPELLANT DISTRIBUTION Multi-element, penetrating injector

INJECTOR PRESSURE DROP AT FLOW RATE
69 H/cm² @ .0095 kg/sec
100 PSID @ .02 lbm/sec)

CATALYST -

TYPE Shell 405 ABSG
 PELLET SIZE(S) 30-35, 14-18, and 30-35
 RETENTION TECHNIQUE Mid-screen and end retainer

BED DIAMETER 2.44 cm (.960 in)
 BED LENGTH 1.47 cm (.579 in)
 BED LOADING kg/sec/cm² (.015-.029 lbm/sec/in²)

HEATER -

NOMINAL SUPPLY VOLTAGE Vdc,
 MAXIMUM POWER WATTS @ Vdc, °C (..... °F)
 CATALYST BED TEMPERATURE °C (..... °F)

VALVE -

THRUSTER-VALVE INTERFACE DESCRIPTION Mechanical

PROOF PRESSURE 414 N/cm² (600 PSIA)
 BURST PRESSURE 965 N/cm² (1400 PSIA)
 EXTERNAL LEAKAGE 1x10⁻⁴ scc/s OF He @ 207 N/cm² (300 PSIA)

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE continued

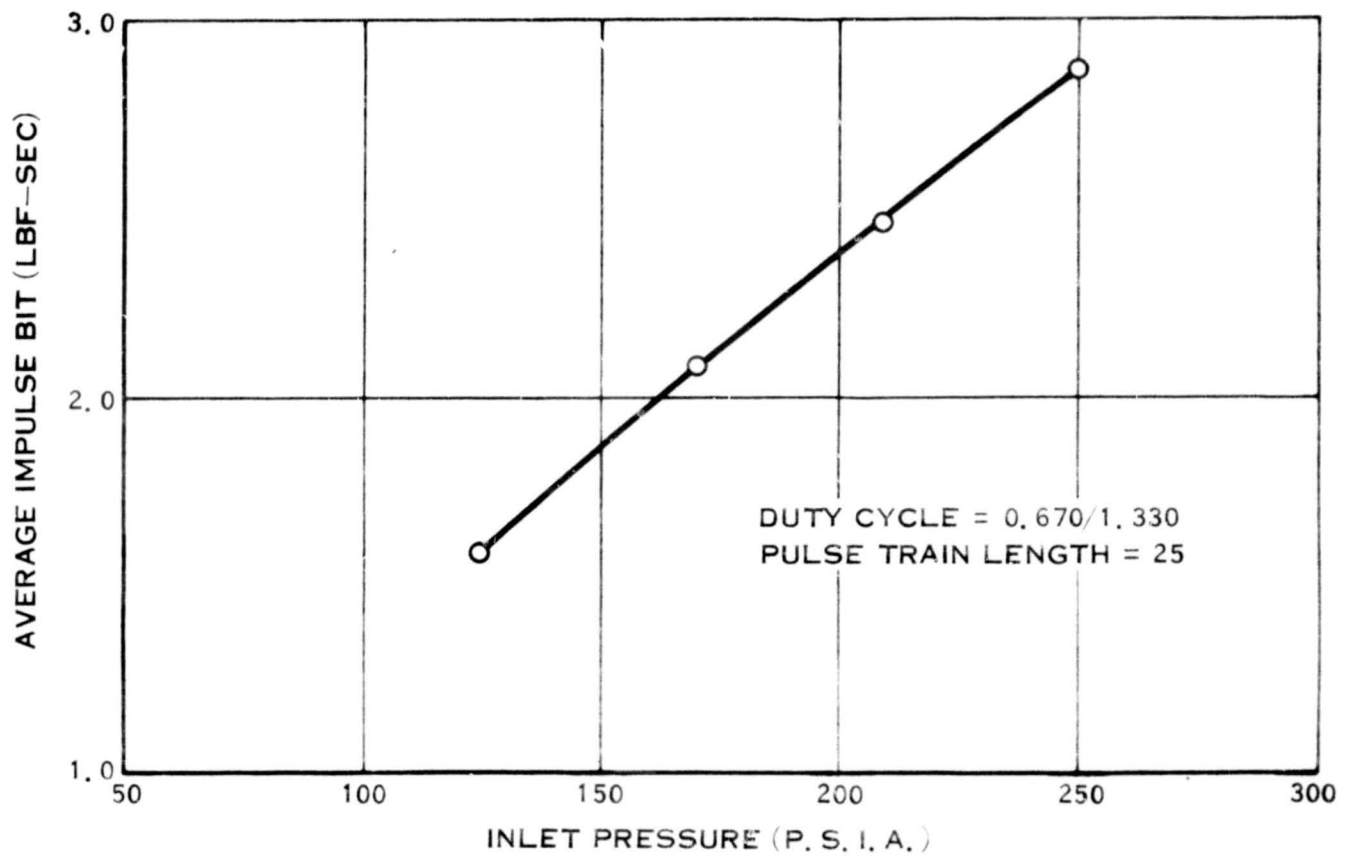
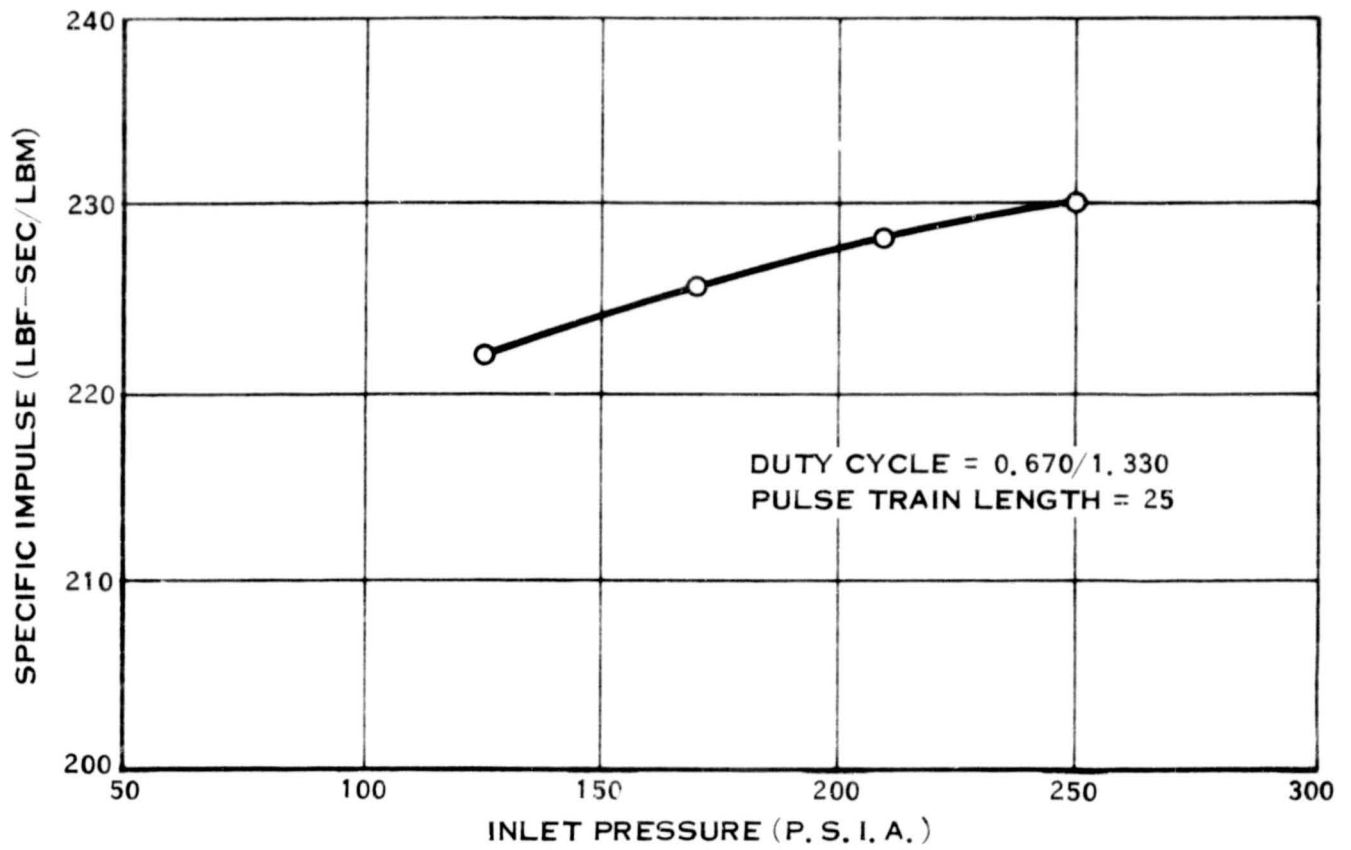
MATERIAL -

CHAMBER	Inconel 625
STANDOFF	Inconel 625
CATALYST RETAINER	L-605

MASS -

WITH VALVE .....	.45	kg	(1.0	lbm)
WITHOUT VALVE		kg	(	lbm)
OTHER		kg	(	lbm)

OTHER SIGNIFICANT CHARACTERISTICS

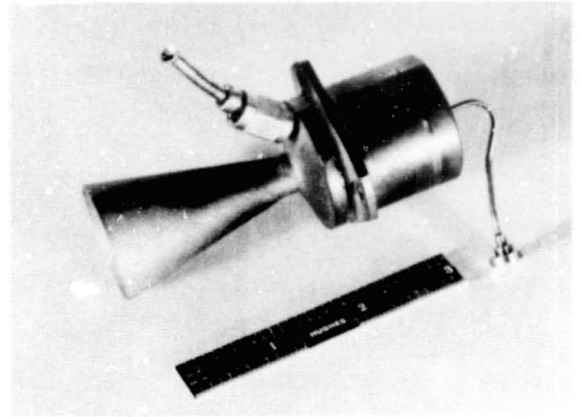


ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE

MANUFACTURER Hughes Aircraft Co. (52)

PART NUMBER 328F410-100



VALVE MANUFACTURER..... PART NUMBER _____

HEATER MANUFACTURER..... PART NUMBER _____

SENSOR MANUFACTURERS.....

TEMPERATURE TRANSDUCER PART NUMBER _____

PRESSURE TRANSDUCER PART NUMBER _____

PROGRAM.....

CONTRACTING AGENCY

PRIME CONTRACTOR

STATUS

QUALIFIED Yes

FLOWN

LAUNCH VEHICLE

AVAILABILITY 9 month lead time

COST/PROCUREMENT INFORMATION... \$25,000

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ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE

N₂H₄

PROPELLANT.....
 VACUUM THRUST RANGE 11-28 N (2.6-6.5 lbf)
 INLET PRESSURE RANGE 55-241 N/cm² (80-350 PSIA)
 INLET TEMPERATURE RANGE 4.4 to 60 °C (40 to 140 °F)
 MINIMUM IMPULSE BIT 2.8 N-sec @ 137 N/cm² INLET P, _____ °C CATALYST BED TEMP.
 (.63 lbf-sec @ 200 PSIA, _____ °F CATALYST BED TEMP)

IMPULSE BIT REPEATABILITY @ N/cm² (_____ PSIA) INLET PRESSURE:
 3σ REPEATABILITY PULSE NUMBER
± 8.5 % 20
± % _____
± % _____

CENTROID LOCATION REPEATABILITY FOR _____ sec VALVE ON-TIME:
 3σ REPEATABILITY PULSE NUMBER
± % _____
± % _____
± % _____

CHAMBER PRESSURE ROUGHNESS ± 5 %

RESPONSE -

TIME FROM VALVE-ON SIGNAL TO 90% STEADY STATE P_c: 50 sec

TIME FROM VALVE-OFF SIGNAL TO 10% STEADY STATE P_c: 65 sec

STEADY STATE VACUUM SPECIFIC IMPULSE N-sec/kg (230 lbf-sec/lbm)

LIFE -

TOTAL IMPULSE 3.1136 x 10⁵ N-sec (70,000 lbf-sec)
 TOTAL THROUGHPUT 146 kg (323 lbm)
 TOTAL NUMBER OF COLD STARTS 264 @ _____ °C (_____ °F)
 TOTAL NUMBER OF PULSES..... 105,000

STEADY STATE DUTY CYCLE -

TOTAL ON-TIME 285 sec demonstrated in qual
 MAXIMUM ON-TIME 135 sec test, can provide more

PULSE MODE DUTY CYCLE -

TEMPERATURE AT START OF PULSE TRAIN 60 °C (15°F) Ambient Start
 NOMINAL PULSE TRAIN LENGTH 145 PULSES 20 ± 140C (-6.6 ± 10°F)
 NOMINAL ON-TIME(S) 175 sec 40-7200 pulses
 NOMINAL OFF-TIME(S) 825 sec 87.5, 175 ms
912.5, 825 ms

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE continued

P/N 328F410-100

LAUNCH ENVIRONMENT -

RANDOM VIBRATION -

WIDE BAND LEVEL G_{rms}
 MAX POWER SPECTRAL DENSITY G^2/Hz from _____ to _____ Hz

SINUSOIDAL VIBRATION -

SWEEP RATE OCTAVES/min
 MAX G LEVEL (O-PEAK) AT _____ Hz
 AT _____ Hz
 AT _____ Hz

ACOUSTIC VIBRATION -

OVERALL SOUND PRESSURE LEVEL dB FOR _____ MINUTES

SHOCK RESPONSE -

WAVE FORM PEAK-LEVEL OF G's FOR _____ sec
 SHOCK SPECTRUM-PEAK RESPONSE OF G's AT _____ Hz
 AMPLIFICATION FACTOR (Q)

STATIC ACCELERATION G's

INJECTOR -

PATTERN OF PROPELLANT DISTRIBUTION

Axial and Radial

INJECTOR PRESSURE DROP AT FLOW RATE

_____ N/cm^2 @ _____ kg/sec
 (_____ PSID @ _____ lbm/sec)

CATALYST -

TYPE

Shell 405, ABS G

PELLET SIZE(S)

14-18, 20-30

RETENTION TECHNIQUE

Catalyst Bed Screen

BED DIAMETER

_____ cm (_____ in)

BED LENGTH

_____ cm (_____ in)

BED LOADING

_____ $kg/sec/cm^2$ (_____ $lbm/sec/in^2$)

HEATER -

NOMINAL SUPPLY VOLTAGE

_____ Vdc,

MAXIMUM POWER

_____ WATTS @ _____ Vdc, _____ $^{\circ}C$ (_____ $^{\circ}F$)

CATALYST BED TEMPERATURE

_____ $^{\circ}C$ (_____ $^{\circ}F$)

VALVE -

THRUSTER-VALVE INTERFACE DESCRIPTION

PROOF PRESSURE

361 N/cm^2 (525 PSIA)

BURST PRESSURE

> 1103 N/cm^2 (> 1600 PSIA)

EXTERNAL LEAKAGE

0 scc/s OF N_2 @ 206 N/cm^2 (300 PSIA)

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE continued

MATERIAL -

CHAMBER L-605, Inconel 600

STANDOFF

CATALYST RETAINER

MASS -

WITH VALVE526 kg (1.16 lbm)

WITHOUT VALVE kg (lbm)

OTHER kg (lbm)

OTHER SIGNIFICANT CHARACTERISTICS

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE

MANUFACTURER Hamilton Standard (54)

PART NUMBER SV755458-1

VALVE MANUFACTURER..... Hydraulic Research PART NUMBER 48002330
HEATER MANUFACTURER..... _____ PART NUMBER _____
SENSOR MANUFACTURERS.....
 TEMPERATURE TRANSDUCER None PART NUMBER _____
 PRESSURE TRANSDUCER None PART NUMBER _____
PROGRAM..... Transit Improvement (TIP-II)
CONTRACTING AGENCY APL/JHU
PRIME CONTRACTOR RCA Astro Electronics
STATUS
 QUALIFIED Intelsat IV
 FLOWN _____
 LAUNCH VEHICLE _____
AVAILABILITY _____
COST/PROCUREMENT INFORMATION... _____

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE

PROPELLANT..... Hydrazine

VACUUM THRUST RANGE 25-12 N (5.7 to 2.8 lbf)

INLET PRESSURE RANGE 241-68.9 N/cm² (350-100 PSIA)

INLET TEMPERATURE RANGE 5 to 50 °C (41 to 122 °F)

MINIMUM IMPULSE BIT 1.3 N-sec @ 226 N/cm² INLET P, 21 °C CATALYST BED TEMP.
(0.3 lbf-sec @ 330 PSIA, 70 °F CATALYST BED TEMP)

IMPULSE BIT REPEATABILITY @ 226-68.9 N/cm² (330 PSIA) INLET PRESSURE:
3σ REPEATABILITY 100 PULSE NUMBER
± 8.0 % All < 1 min.
± %
± %

CENTROID LOCATION REPEATABILITY FOR _____ sec VALVE ON-TIME:
3σ REPEATABILITY PULSE NUMBER
± %
± %
± %

CHAMBER PRESSURE ROUGHNESS ± 3.0 %

RESPONSE -
TIME FROM VALVE-ON SIGNAL TO 90% STEADY STATE P_c: _____ sec
TIME FROM VALVE-OFF SIGNAL TO 10% STEADY STATE P_c: _____ sec

STEADY STATE VACUUM SPECIFIC IMPULSE _____ N-sec/kg , (232 2 lbf-sec/lbm) Max.

LIFE -
TOTAL IMPULSE 57,824 N-sec (13,000 lbf-sec)
TOTAL THROUGHPUT 27 kg (60 lbm)
TOTAL NUMBER OF COLD STARTS 25 @ _____ °C (< 70 °F)
TOTAL NUMBER OF PULSES..... _____

STEADY STATE DUTY CYCLE -
TOTAL ON-TIME _____ sec
MAXIMUM ON-TIME 300 sec

PULSE MODE DUTY CYCLE -
TEMPERATURE AT START OF PULSE TRAIN _____ °C (_____ °F)
NOMINAL PULSE TRAIN LENGTH .. _____ PULSES
NOMINAL ON-TIME(S) _____ sec
NOMINAL OFF-TIME(S) _____ sec

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE continued

P/N SV755458-1

LAUNCH ENVIRONMENT -

RANDOM VIBRATION -

WIDE BAND LEVEL G_{rms}
 MAX POWER SPECTRAL DENSITY G^2/Hz from _____ to _____ Hz

SINUSOIDAL VIBRATION -

SWEEP RATE OCTAVES/min
 MAX G LEVEL (0-PEAK) AT _____ Hz
 AT _____ Hz
 AT _____ Hz

ACOUSTIC VIBRATION -

OVERALL SOUND PRESSURE LEVEL dB FOR _____ MINUTES

SHOCK RESPONSE -

WAVE FORM PEAK-LEVEL OF G's FOR _____ sec
 SHOCK SPECTRUM-PEAK RESPONSE OF G's AT _____ Hz
 AMPLIFICATION FACTOR (Q)

STATIC ACCELERATION G's

INJECTOR -

PATTERN OF PROPELLANT DISTRIBUTION

INJECTOR PRESSURE DROP AT FLOW RATE N/cm^2 @ _____ kg/sec
 (_____ PSID @ _____ lbm/sec)

CATALYST -

TYPE ABSG
 PELLET SIZE(S) 14 - 30
 RETENTION TECHNIQUE Screens
 BED DIAMETER cm (_____ in)
 BED LENGTH cm (_____ in)
 BED LOADING $kg/sec/cm^2$ (_____ lbm/sec/in²)

HEATER -

NOMINAL SUPPLY VOLTAGE 16 Vdc,
 MAXIMUM POWER 12.5 WATTS @ _____ Vdc, _____ °C (_____ °F)
 CATALYST BED TEMPERATURE °C (_____ °F)

VALVE -

THRUSTER-VALVE INTERFACE DESCRIPTION

Bolted with "O" Ring Seal

PROOF PRESSURE 341 N/cm^2 (_____ 495 PSIA)
 BURST PRESSURE 455 N/cm^2 (_____ 660 PSIA)

EXTERNAL LEAKAGE 1×10^{-6} scc/s OF He @ 227 N/cm^2 (_____ 330 PSIA)

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE continued

MATERIAL -

CHAMBER
STANDOFF
CATALYST RETAINER

MASS -

WITH VALVE	<u>.49</u> kg	(<u>1.1</u> lbm)
WITHOUT VALVE	<u>.2</u> kg	(<u>.6</u> lbm)
OTHER	_____ kg	(_____ lbm)

OTHER SIGNIFICANT CHARACTERISTICS

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE

MANUFACTURER Rocket Research (22)

PART NUMBER MR-50H

VALVE MANUFACTURER..... Parker-Hannifin PART NUMBER 5690023
HEATER MANUFACTURER..... _____ PART NUMBER _____
SENSOR MANUFACTURERS.....
 TEMPERATURE TRANSDUCER _____ PART NUMBER _____
 PRESSURE TRANSDUCER _____ PART NUMBER _____
PROGRAM..... P-95, Block III
CONTRACTING AGENCY _____
PRIME CONTRACTOR LMSC
STATUS
 QUALIFIED Yes
 FLOWN _____
 LAUNCH VEHICLE _____
AVAILABILITY _____
COST/PROCUREMENT INFORMATION... _____

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE

PROPELLANT..... N₂H₄

VACUUM THRUST RANGE 14.4 N @ 80.6 N/cm² (3.25 lbf @ 117 psia)
24.6 N @ 160 N/cm² (5.55 lbf @ 233 psia)

INLET PRESSURE RANGE 75.8-182 N/cm² (110-264 PSIA)

INLET TEMPERATURE RANGE 4.4 to 60 °C (40 to 140 °F)

MINIMUM IMPULSE BIT5387 N-sec @ 160 N/cm² INLET P, 471 °C CATALYST BED TEMP
(.1218 lbf-sec @ 233 PSIA, 880 °F CATALYST BED TEMP)

IMPULSE BIT REPEATABILITY @ 80.6 N/cm² (117 PSIA) INLET PRESSURE:
3σ REPEATABILITY PULSE NUMBER

<u>± 21.1 %</u>	<u>100</u>
<u>± %</u>	<u></u>
<u>± %</u>	<u></u>

CENTROID LOCATION REPEATABILITY FOR _____ sec VALVE ON-TIME:

<u>3σ REPEATABILITY</u>	<u>PULSE NUMBER</u>
<u>± N/A %</u>	<u></u>
<u>± %</u>	<u></u>
<u>± %</u>	<u></u>

CHAMBER PRESSURE ROUGHNESS 2 %

<u>T</u>	<u>P</u>	<u>TW</u>
<u>1.2</u>	<u>233</u>	<u>500</u>
<u>2.6</u>	<u>117</u>	<u>500</u>

RESPONSE -

TIME FROM VALVE-ON SIGNAL TO 90% STEADY STATE P_c: _____ sec

TIME FROM VALVE-OFF SIGNAL TO 10% STEADY STATE P_c: < .16 sec

STEADY STATE VACUUM SPECIFIC IMPULSE _____ N-sec/kg (231 lbf-sec/lbm)

LIFE -

TOTAL IMPULSE 2 x 10⁴ N-sec (5 x 10³ lbf-sec)

TOTAL THROUGHPUT 93.8 kg (207 lbm)

TOTAL NUMBER OF COLD STARTS 3-25 °C (95 °F)

TOTAL NUMBER OF PULSES..... 5.37 x 10⁵

STEADY STATE DUTY CYCLE -

TOTAL ON-TIME N/A sec

MAXIMUM ON-TIME 300 sec

PULSE MODE DUTY CYCLE -

TEMPERATURE AT START OF PULSE TRAIN 35 °C (95 °F)

NOMINAL PULSE TRAIN LENGTH Any PULSES

NOMINAL ON-TIME(S) 0.022 sec

NOMINAL OFF-TIME(S) Any sec

4.3.1 THRUSTER, HYDRAZINE continued

LAUNCH ENVIRONMENT -

RANDOM VIBRATION -

WIDE BAND LEVEL 37.9 G_{rms}
MAX POWER SPECTRAL DENSITY 1.0 G^2/Hz from 100 to 1000 Hz

SINUSOIDAL VIBRATION -

SWEEP RATE 2.0 OCTAVES/min

MAX G LEVEL (0-PEAK) 2.0 AT 5-50 Hz

4.0 AT 50-2000 Hz

AT _____ Hz

ACOUSTIC VIBRATION -

OVERALL SOUND PRESSURE LEVEL 152 dB FOR 3 MINUTES

SHOCK RESPONSE -

WAVE FORM PEAK-LEVEL OF 8.0 G's FOR .008 sec

SHOCK SPECTRUM-PEAK RESPONSE OF G's AT Hz

AMPLIFICATION FACTOR (Q)

STATIC ACCELERATION 8.0 G's

INJECTOR -

PATTERN OF PROPELLANT DISTRIBUTION Five Speed

INJECTOR PRESSURE DROP AT FLOW RATE $\frac{10.6}{15.5}$ N/cm² @ $\frac{.00621}{.0137}$ kg/sec
(lbm/sec)

CATALYST -

She11 405

PELLET SIZE(S) 25-30 mesh & 14-18 mesh

RETENTION TECHNIQUE Bed Plates & Screens

BED DIAMETER 2.994 cm (1.179 in)

BED LENGTH 2.28 cm (0.90 in)

BED LOADING0571 kg/sec/cm² (0.0225 lbm/sec/in²)

HEATER -

NOMINAL SUPPLY VOLTAGE 28 Vdc.

MAXIMUM POWER 1 WATTS @ 32 Vdc, 21 °C (70 °F)

CATALYST BED TEMPERATURE 35 °C (95 °F)

VALVE -

THRUSTER-VALVE INTERFACE DESCRIPTION Welded

PROOF PRESSURE 448 N/cm² (650 PSIA)

BURST PRESSURE N/A N/cm² (PSIA)

EXTERNAL LEAKAGE 6×10^{-6} scc/s OF _____ @ 224 N/cm² (325 PSIA)

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE continued

MATERIAL -

CHAMBER	<u>Haynes 25</u>
STANDOFF	<u>Haynes 25</u>
CATALYST RETAINER	<u>Haynes 25</u>

MASS -

WITH VALVE	<u>.544</u> kg	(<u>1.20</u> lbm)
WITHOUT VALVE	_____ kg	(_____ lbm)
OTHER	_____ kg	(_____ lbm)

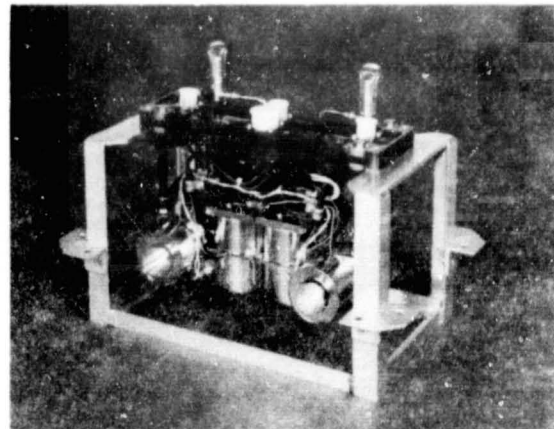
OTHER SIGNIFICANT CHARACTERISTICS

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE

MANUFACTURER Rocket Research Corp.

PART NUMBER MR-50A



VALVE MANUFACTURER..... Parker-Hannifin PART NUMBER 5680036

HEATER MANUFACTURER..... Clayborne PART NUMBER _____

SENSOR MANUFACTURERS.....

TEMPERATURE TRANSDUCER PART NUMBER _____

PRESSURE TRANSDUCER PART NUMBER _____

PROGRAM..... P-95, Block I

CONTRACTING AGENCY

PRIME CONTRACTOR Lockheed Missiles and Space Co.

STATUS

QUALIFIED Yes

FLOWN _____

LAUNCH VEHICLE _____

AVAILABILITY _____

COST/PROCUREMENT INFORMATION... _____

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4.3.1-79

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE

PROPELLANT..... N_2H_4

VACUUM THRUST RANGE 25.6 N @ 160 N/cm² (5.77 lbf @ 233 psia)
 14.5 N @ 80.6 N/cm² (3.27 lbf @ 117 psia)

INLET PRESSURE RANGE 75.8-182 N/cm² (110-264 PSIA)

INLET TEMPERATURE RANGE 4.44-60 °C (40-140 °F)

MINIMUM IMPULSE BIT 160 N-sec @ 160 N/cm² INLET P, 437 °C CATALYST BED TEMP.
 (0.1102 lbf-sec @ 233 PSIA, 820 °F CATALYST BED TEMP)

IMPULSE BIT REPEATABILITY @ 80.6 N/cm² (117 PSIA) INLET PRESSURE:
 3σ REPEATABILITY PULSE NUMBER
 ± 25 % 100
 ± %
 ± %

CENTROID LOCATION REPEATABILITY FOR sec VALVE ON TIME:
 3σ REPEATABILITY PULSE NUMBER
 ± N/A %
 ± %
 ± %

CHAMBER PRESSURE ROUGHNESS ± 8.9 N/cm²
 (13 psid) at 175 K pulses

RESPONSE -
 TIME FROM VALVE-ON SIGNAL TO 85% STEADY STATE P_c: < 2.5 sec
 TIME FROM VALVE-OFF SIGNAL TO 10% STEADY STATE P_c: < 0.15 sec

STEADY STATE VACUUM SPECIFIC IMPULSE N-sec/kg (231 lbf-sec/lbm)

LIFE -
 TOTAL IMPULSE N-sec (20.5K lbf-sec)
 TOTAL THROUGHPUT 42 kg (1bm)
 TOTAL NUMBER OF COLD STARTS 50 @ 35 °C (95 °F)
 TOTAL NUMBER OF PULSES..... 175 x 10⁵

STEADY STATE DUTY CYCLE -
 TOTAL ON-TIME N/A sec
 MAXIMUM ON-TIME 1200 sec

PULSE MODE DUTY CYCLE -
 TEMPERATURE AT START OF PULSE TRAIN 35 °C (95 °F)
 NOMINAL PULSE TRAIN LENGTH any PULSES
 NOMINAL ON-TIME(S) 0.022 sec
 NOMINAL OFF-TIME(S) any sec

4.3.1 THRUSTER, HYDRAZINE continued

LAUNCH ENVIRONMENT -
RANDOM VIBRATION -

WIDE BAND LEVEL $\frac{37.9}{1.0} G_{rms}$
 MAX POWER SPECTRAL DENSITY $\frac{1.0}{1.0} G^2/Hz$ from $\frac{100}{1.0}$ to $\frac{1000}{1.0} Hz$

SINUSOIDAL VIBRATION -

SWEEP RATE 2 OCTAVES/min
MAX G LEVEL (0-PEAK) 2 AT _____ Hz
4 AT _____ Hz
AT _____ Hz

ACOUSTIC VIBRATION -

OVERALL SOUND PRESSURE LEVEL 152 dB FOR 3 MINUTES

SHOCK RESPONSE -

WAVE FORM PEAK-LEVEL OF $38\frac{1}{2}$ sine G's FOR 0.008 sec

SHOCK SPECTRUM-PEAK RESPONSE OF 8000 G'S AT HZ

AMPLIFICATION FACTOR (C) 25

STATIC ACCELERATION 8 G's

INJECTOR -

PATTERN OF PROPELLANT DISTRIBUTION

PATTERN OF PROPELLANT DISTRIBUTION	<u>single speed</u>			
INJECTOR PRESSURE DROP AT FLOW RATE	<u>10.23</u>	N/cm^2 @	<u>.00621</u>	kg/sec
	(<u>14.85</u>	PSID @	<u>0.0137</u>	lbm/sec)

CATALYST -

TYPE Shell 405

PELLET SIZE(S) 25-30 Mesh and 14-18 Mesh

RETENTION TECHNIQUE Bed Plates and Screens

BED DIAMETER02994 cm (1.179 in)

BED LENGTH022 cm (0.90 in)

BED LOADING kg/sec/cm² (0.0225 lbm/sec/in²)

HEATER -

NOMINAL SUPPLY VOLTAGE 28.5 Vdc.

MAXIMUM POWER 2.36 WATTS @ 33 Vdc, _____ °C (_____ °F)

CATALYST BED TEMPERATURE 35 °C (95 °F)

VALVE -

THRUSTER-VALVE INTERFACE DESCRIPTION Welded

PROOF PRESSURE 448 N/cm² (650 PSIA)

BURST PRESSURE 2895 N/cm² (4200 PSIA)

EXTERNAL LEAKAGE $< 6 \times 10^{-6}$ scc/s OF He @ 224 N/cm² (325 PSIA)

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE continued

MATERIAL -

CHAMBER	<u>Haynes 25</u>
STANDOFF	<u>Haynes 25</u>
CATALYST RETAINER	<u>Haynes 25</u>

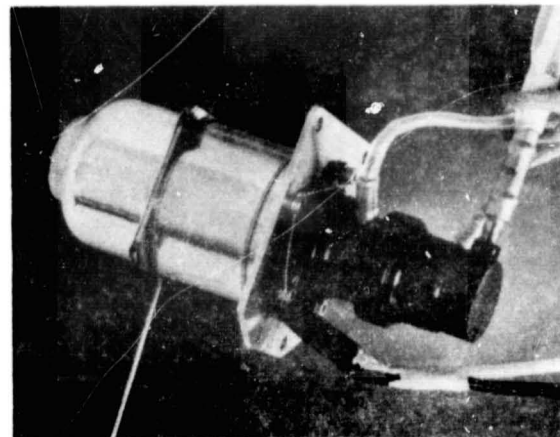
MASS -

WITH VALVE	_____ kg	(_____ lbm)
WITHOUT VALVE	<u>.544</u> kg	(<u>1.2</u> lbm)
OTHER	_____ kg	(_____ lbm)

OTHER SIGNIFICANT CHARACTERISTICS

4.3.1 THRUSTER, HYDRAZINE

PART NUMBER MR-50F



4.3.1-83

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE

PROPELLANT.....	<u>N₂H₄</u>	
VACUUM THRUST RANGE	<u>39-15</u> N	(<u>8.7-3.3</u> lbf)
INLET PRESSURE RANGE	<u>331-93</u> N/cm ²	(<u>480-135</u> PSIA)
INLET TEMPERATURE RANGE	<u>7 to 32</u> °C	(<u>45 to 90</u> °F)
MINIMUM IMPULSE BIT	<u>0.32</u> N-sec @ <u>97</u> N/cm ²	INLET P, <u>482</u> °C CATALYST BED TEMP.
	(<u>.071</u> lbf-sec @ <u>140</u> PSIA, <u>900</u> °F CATALYST BED TEMP)	
IMPULSE BIT REPEATABILITY @	N/cm ² (PSIA) INLET PRESSURE:	
	3σ REPEATABILITY	PULSE NUMBER
	<u>±</u> %	
	<u>±</u> %	
	<u>±</u> %	
CENTROID LOCATION REPEATABILITY FOR <u>N/A</u> sec VALVE ON-TIME:		
	3σ REPEATABILITY	PULSE NUMBER
	<u>N/A</u> %	
	<u>±</u> %	
	<u>±</u> %	
CHAMBER PRESSURE ROUGHNESS	<u>± 15</u> %	
RESPONSE -		
TIME FROM VALVE-ON SIGNAL TO 90% STEADY STATE P _c :	<u>.045</u> sec	@ > 93° C (200° F)
TIME FROM VALVE-OFF SIGNAL TO 10% STEADY STATE P _c :	<u>.055</u> sec	
STEADY STATE VACUUM SPECIFIC IMPULSE @331. $\frac{N}{Im^2}$	<u>2211</u> N-sec/kg	(<u>225.5</u> lbf-sec/lbm) @480 psia
LIFE - @93 $\frac{N}{Im^2}$	<u>2118</u> N-sec/kg	(<u>216.0</u> lbf-sec/lbm)@135 psia
TOTAL IMPULSE	<u>64900</u> N-sec	(<u>14600</u> lbf-sec)
TOTAL THROUGHPUT	<u>32</u> kg	(<u>70</u> lbm)
TOTAL NUMBER OF COLD STARTS	<u>5</u> @ <u>4 to 21</u> °C	(<u>40 to 70</u> °F)
TOTAL NUMBER OF PULSES.....	<u>1.6 x 10⁴</u>	
STEADY STATE DUTY CYCLE -		
TOTAL ON-TIME	<u>3820</u> sec	
MAXIMUM ON-TIME	<u>1210</u> sec	
PULSE MODE DUTY CYCLE -		
TEMPERATURE AT START OF PULSE TRAIN	<u>482 to 668</u> °C	(<u>900 to 1235</u> °F)
NOMINAL PULSE TRAIN LENGTH	<u>100</u> PULSES	
NOMINAL ON-TIME(S)	<u>.020, .040, .060, .10, .20, .5, 1.0</u> sec	
NOMINAL OFF-TIME(S)	<u>5. - 300.</u> sec	

4.3.1-84

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE continued

P/N MR-50F

LAUNCH ENVIRONMENT - RANDOM VIBRATION -

WIDE BAND LEVEL 16.6 G_{rms}
MAX POWER SPECTRAL DENSITY 0.20 G^2/Hz from 250 to 1000 Hz

SINUSOIDAL VIBRATION -

SWEEP RATE 1 OCTAVES/min
MAX G LEVEL (0-PEAK) 0.4 inc AT 5-19 Hz
..... 7.5 AT 19-250 Hz
..... AT _____ Hz

ACOUSTIC VIBRATION -

OVERALL SOUND PRESSURE LEVEL 146 dB FOR 300 MINUTES

SHOCK RESPONSE -

WAVE FORM PEAK-LEVEL OF N/A G's FOR _____ sec
SHOCK SPECTRUM-PEAK RESPONSE OF G's AT _____ Hz
AMPLIFICATION FACTOR (Q) _____

STATIC ACCELERATION 5 G's

INJECTOR -

PATTERN OF PROPELLANT DISTRIBUTION Single Dispersion Element
INJECTOR PRESSURE DROP AT FLOW RATE 72 W/cm^2 @ .016 kg/sec
(105 PSID @ .0352 lbm/sec)

CATALYST -

TYPE Shell 405
PELLET SIZE(S) 25-30 mesh & 14-18 mesh
RETENTION TECHNIQUE Bed Plates & Screens
BED DIAMETER 2.994 cm (1.179 in)
BED LENGTH 2.29 cm (0.90 in)
BED LOADING0025 kg/sec/cm² (0.035 lbm/sec/in²)

HEATER -

NOMINAL SUPPLY VOLTAGE 33.0 Vdc,
MAXIMUM POWER 0.55 WATTS @ 31.35 Vdc, 16 °C (60 °F)
CATALYST BED TEMPERATURE 4.4 °C (40 °F)

VALVE -

THRUSTER-VALVE INTERFACE DESCRIPTION Welded joint

PROOF PRESSURE 683 N/cm² (998 PSIA)

BURST PRESSURE N/A N/cm² (_____ PSIA)

EXTERNAL LEAKAGE 1 x 10 acc/s OF He @ 372 N/cm² (540 PSIA)

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE continued

MATERIAL -

CHAMBER Haynes 25

STANDOFF Haynes 25

CATALYST RETAINER Haynes 25

MASS -

WITH VALVE kg (..... lbm)

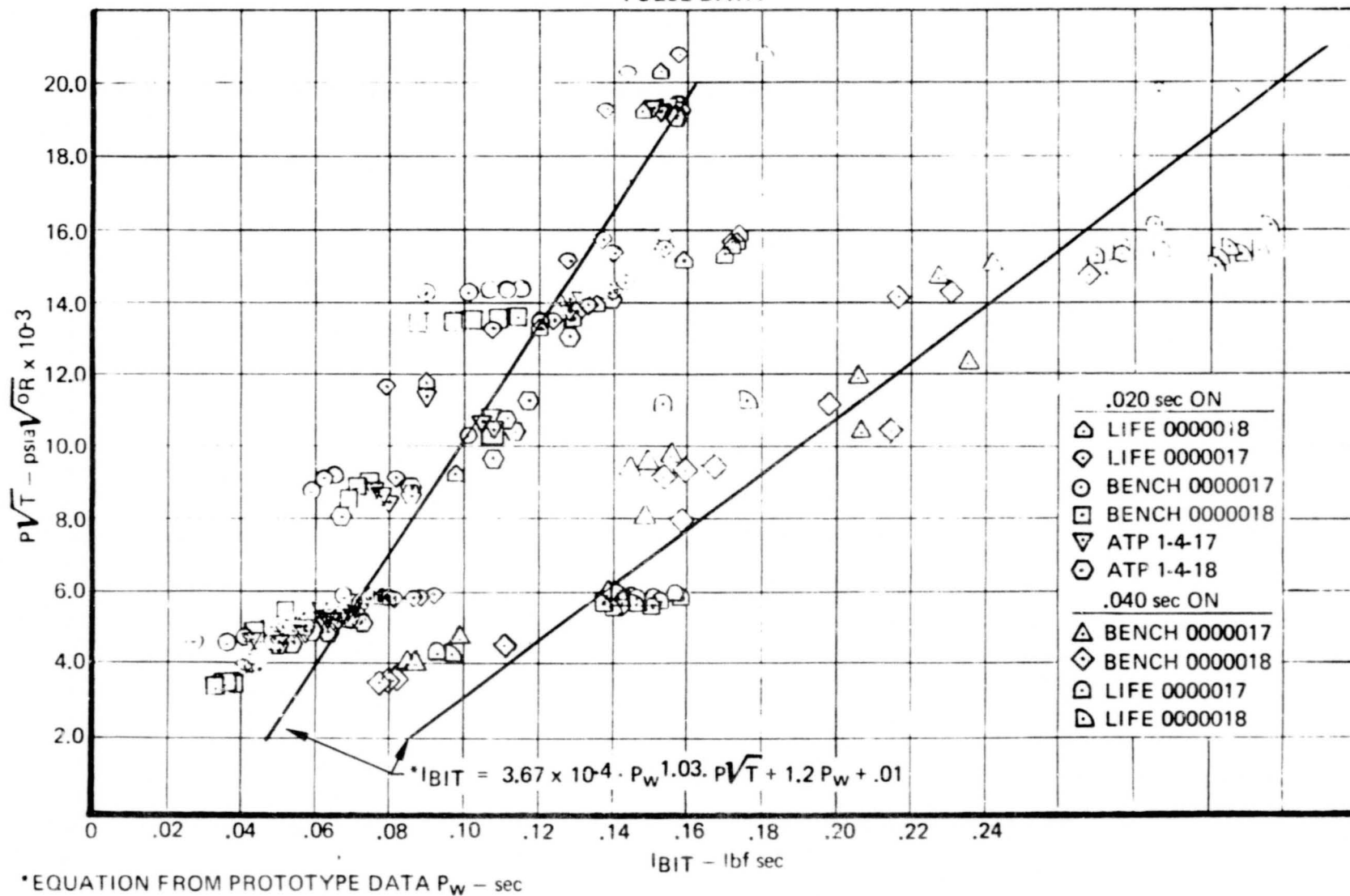
WITHOUT VALVE kg (..... lbm)

OTHER 0.74 kg (1.627 lbm)

OTHER SIGNIFICANT CHARACTERISTICS

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VIKING RCS QUAL TEST PULSE DATA



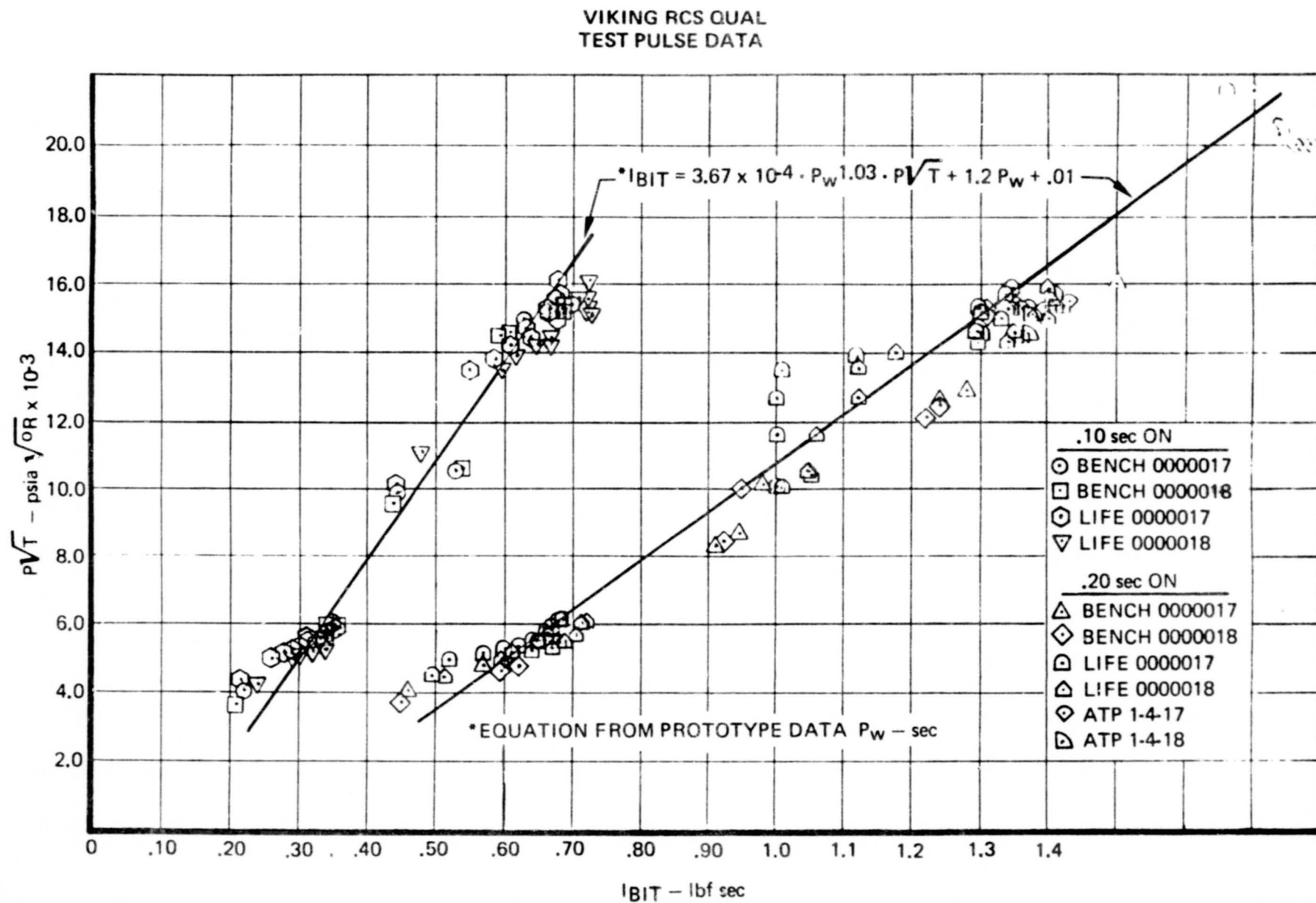
4.3.1-87

Figure 1

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4.3.1-88

Figure 2



PULSE MODE VACUUM SPECIFIC IMPULSE QUALIFICATION REA ATP'S

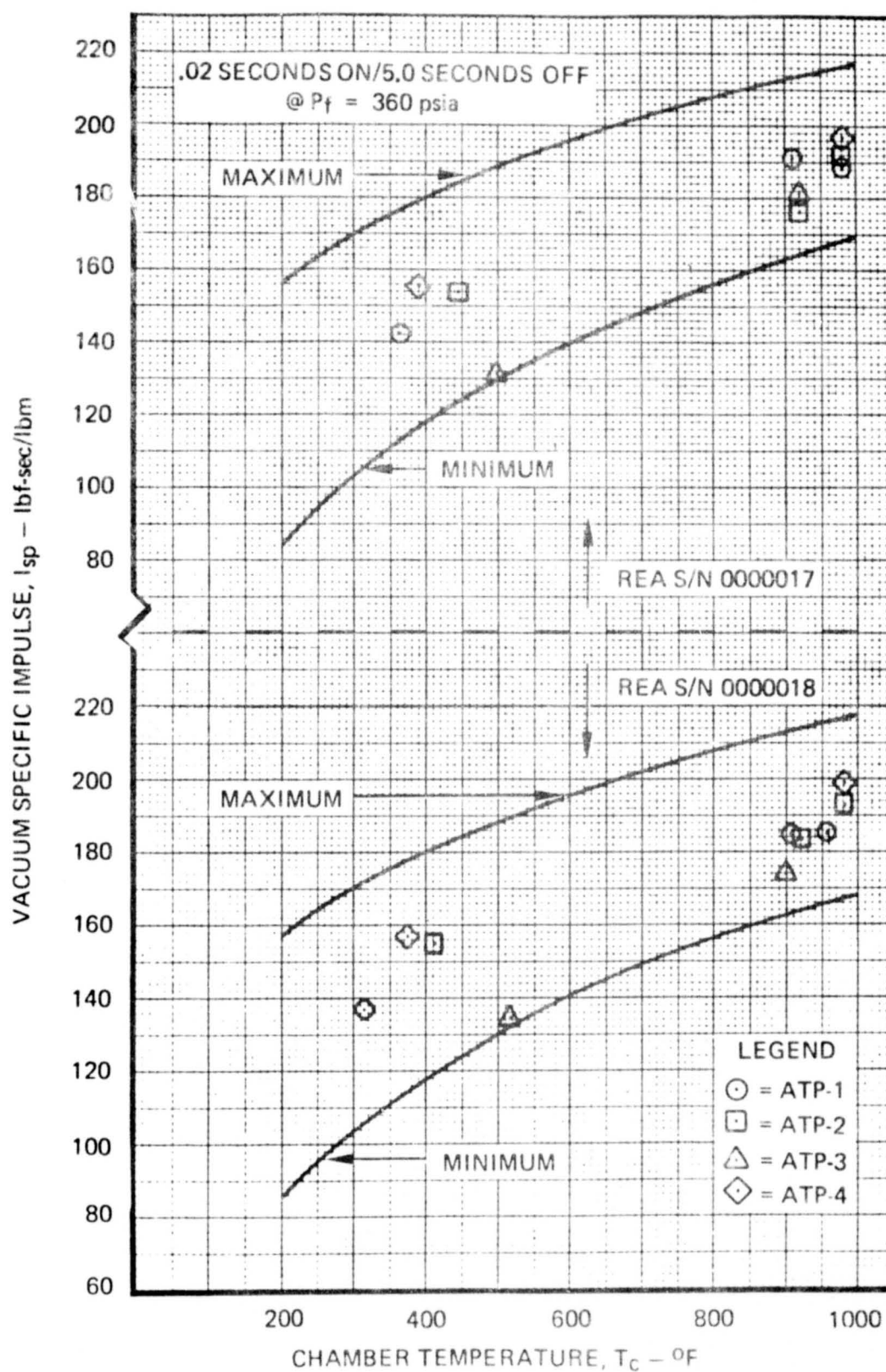


Figure 3

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Impulse Bit

<u>N-sec</u>	<u>lb-sec</u>	<u>3 σ Repeatability</u>	<u>Inlet Pressure</u>	<u>Pulse Width</u>	<u>Bed Temperature</u>
0.72	(0.161)	$\pm 9.3\%$	345 N/m ² (500 psia)	20 MS	482 to 538°C (900 to 1000°F)
0.32	(0.071)	$\pm 21.1\%$	97 N/m ² (140 psia)	20 MS	482 to 582°C (900 to 1080°F)
7.71	(1.734)	$\pm 7.4\%$	3.45 N/m ² (500 psia)	20 MS	527 to 677°C (980 to 1250°F)
6.23	(1.400)	$\pm 7.4\%$	248 N/m ² (360 psia)	20 MS	1060 to 771°C (1235 to 1420°F)

4.3.1-90

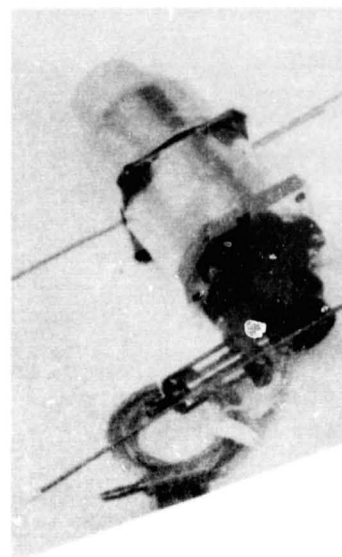
Figure 4

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE

MANUFACTURER Rocket Research Corp. (22)

PART NUMBER MR-50E



VALVE MANUFACTURER.....	<u>Parker-Hannifin</u>	PART NUMBER <u>5710057</u>
		<u>RRC26605 (Catalyst Htr)</u>
HEATER MANUFACTURER.....	<u>Clayborne Labs</u>	PART NUMBER <u>RRC26137 (Valve Htr)</u>
SENSOR MANUFACTURERS.....		
TEMPERATURE TRANSDUCER	<u>N/A</u>	PART NUMBER _____
PRESSURE TRANSDUCER	_____	PART NUMBER _____
PROGRAM.....	<u>SMS, Meteosat</u>	
CONTRACTING AGENCY	<u>NASA</u>	
PRIME CONTRACTOR	<u>Philco-Ford, Marconi (England)</u>	
STATUS		
QUALIFIED	<u>Yes</u>	
FLOWN	<u>Yes (SMS), No (Meteosat)</u>	
LAUNCH VEHICLE	<u>Thor-delta (SMS)</u>	
AVAILABILITY	_____	
COST/PROCUREMENT INFORMATION...	_____	

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE

PROPELLANT.....	<u>N₂H₄</u>	
VACUUM THRUST RANGE	<u>2.0</u> N	(<u>5.0</u> lbf)
INLET PRESSURE RANGE	<u>172</u> N/cm ²	(<u>250</u> PSIA)
INLET TEMPERATURE RANGE	<u>10-37.7</u> °C	(<u>50-100</u> °F)
MINIMUM IMPULSE BIT	<u>N/A</u> N-sec @ _____ N/cm ² INLET P, _____ °C CATALYST BED TEMP. (_____ lbf-sec @ _____ PSIA, _____ °F CATALYST BED TEMP)	
IMPULSE BIT REPEATABILITY @	<u>172,124</u> N/cm ²	(<u>250</u> PSIA) INLET PRESSURE: 3σ REPEATABILITY PULSE NUMBER
first 10,000 pulses	<u>± 5</u> %	<u>Trains of 50-500</u>
pulses > 10,000	<u>± 10</u> %	<u>Trains of 50-500</u>
	<u>±</u> %	_____
CENTROID LOCATION REPEATABILITY FOR <u>.080</u> sec VALVE ON-TIME:	3σ REPEATABILITY	PULSE NUMBER
P _f = 250 or 180 psia	<u>± 6.0</u> %	Any 50 pulse group at a
P _f = 70 psia	<u>± 16.0</u> %	_____ given point in life
Combined life/pressure effects	<u>±</u> %	See attached curve
CHAMBER PRESSURE ROUGHNESS	<u>± 3</u> %	of max. chamber pressure
RESPONSE -		
TIME FROM VALVE-ON SIGNAL TO 90% STEADY STATE P _c :	<u>0.028</u> sec	
TIME FROM VALVE-OFF SIGNAL TO 10% STEADY STATE P _c :	<u>0.044</u> sec	
STEADY STATE VACUUM SPECIFIC IMPULSE	_____ N-sec/kg	(<u>228</u> lbf-sec/lbm)
LIFE -		
TOTAL IMPULSE	_____ N-sec	(<u>21086</u> lbf-sec)
TOTAL THROUGHPUT	<u>45.3</u> kg	(<u>100</u> lbm)
TOTAL NUMBER OF COLD STARTS	<u>52</u> @ <u>10</u> °C	(<u>50</u> °F)
TOTAL NUMBER OF PULSES.....	<u>21,452</u>	
STEADY STATE DUTY CYCLE -		
TOTAL ON-TIME	<u>3826</u> sec	
MAXIMUM ON-TIME	<u>300</u> sec	
PULSE MODE DUTY CYCLE -		
TEMPERATURE AT START OF PULSE TRAIN	<u>10 to 37.7</u> °C	(<u>50 to 100</u> °F)
NOMINAL PULSE TRAIN LENGTH	<u>250</u> PULSES	
NOMINAL ON-TIME(S)	<u>0.080</u> sec	
NOMINAL OFF-TIME(S)	<u>520</u> sec	

P/N MR-50E

RANDOM VIBRATION -

WIDE BAND LEVEL 11.8 G_{rms}
MAX POWER SPECTRAL DENSITY 0.18 G^2/Hz from 40 to 300 Hz

SWEEP RATE	<u>4</u>	OCTAVES/min
MAX Q LEVEL (Q-PEAK)	<u>14 g</u>	AT <u>10⁻²³</u> Hz
	<u>259</u>	AT <u>30-60</u> Hz
	<u>59</u>	AT <u>200 -</u> 2000 Hz

OVERALL SOUND PRESSURE LEVEL N/A dB FOR _____ MINUTES

WAVE FORM PEAK-LEVEL OF N/A G's FOR sec
SHOCK SPECTRUM-PEAK RESPONSE OF G's AT Hz
AMPLIFICATION FACTOR (G)

N/A	G's
-----	-----

PATTERN OF PROPELLANT DISTRIBUTION

Single Speed

INJECTOR PRESSURE DROP AT FLOW RATE

23.5 li/cm^2 @ .00997 kg/sec
 (34.2 PSID @ 0.022 lbm/sec)

TYPE

She11 405

PELLET SIZE(S)

25-30 mesh & 14-18 mesh

RETENTION TECHNIQUE

Bed Plates & Screens

BED DIAMETER

2.994 cm (1.179 in)

BED LENGTH

2.2 cm (0.90 in)

BED LOADING

.0571 kg/sec/cm² (0.0225 lbm/sec/in²)

NOMINAL SUPPLY VOLTAGE

26-29 V_{dc} .

MAXIMUM POWER

* WATTS @ 29 V_{dc}, 21 °C (70 °F)

CATALYST BED TEMPERATURE

65.6 °C (150 °F)

*1.87 watts max. for catalyst htr.
0.467 watts max. for valve htr.

THRUSTER-VALVE INTERFACE DESCRIPTION

Welded

PROOF PRESSURE

361 N/cm² (525 PSIA)

BURST PRESSURE

965.2 N/cm² (1400 PSIA)

EXTERNAL LEAKAGE

$$10^{-6} \text{ scc/s OF He @ } 217 \text{ N/cm}^2 \text{ (} 315 \text{ PSIA)}$$

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE continued

MATERIAL -

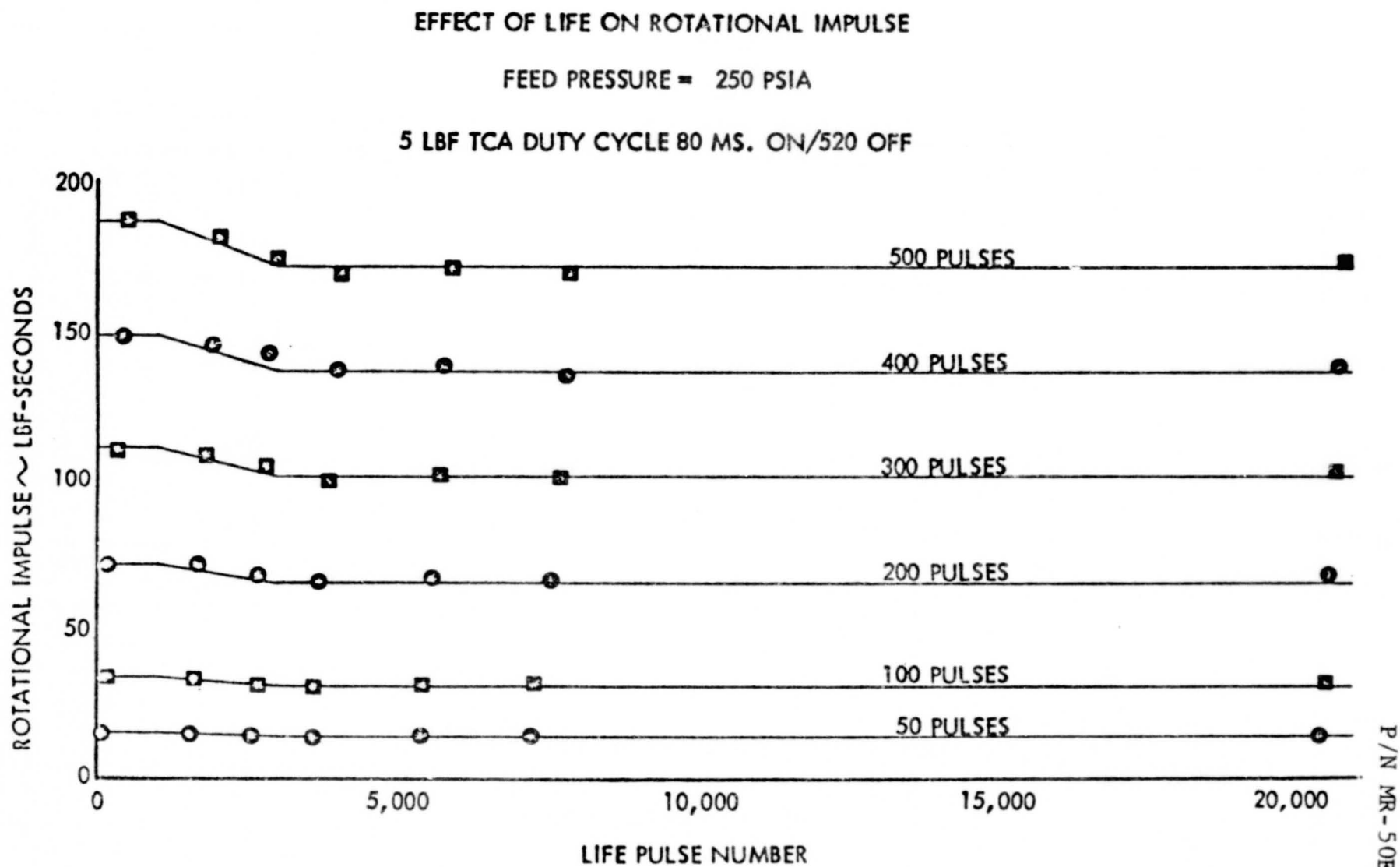
CHAMBER	<u>Haynes 25</u>
STANDOFF	<u>Haynes 25</u>
CATALYST RETAINER	<u>Haynes 25</u>

MASS -

WITH VALVE	_____ kg	(_____ lbm)
WITHOUT VALVE	_____ kg	(_____ lbm)
OTHER	<u>.544</u> kg	(<u>1.20</u> lbm)

OTHER SIGNIFICANT CHARACTERISTICS

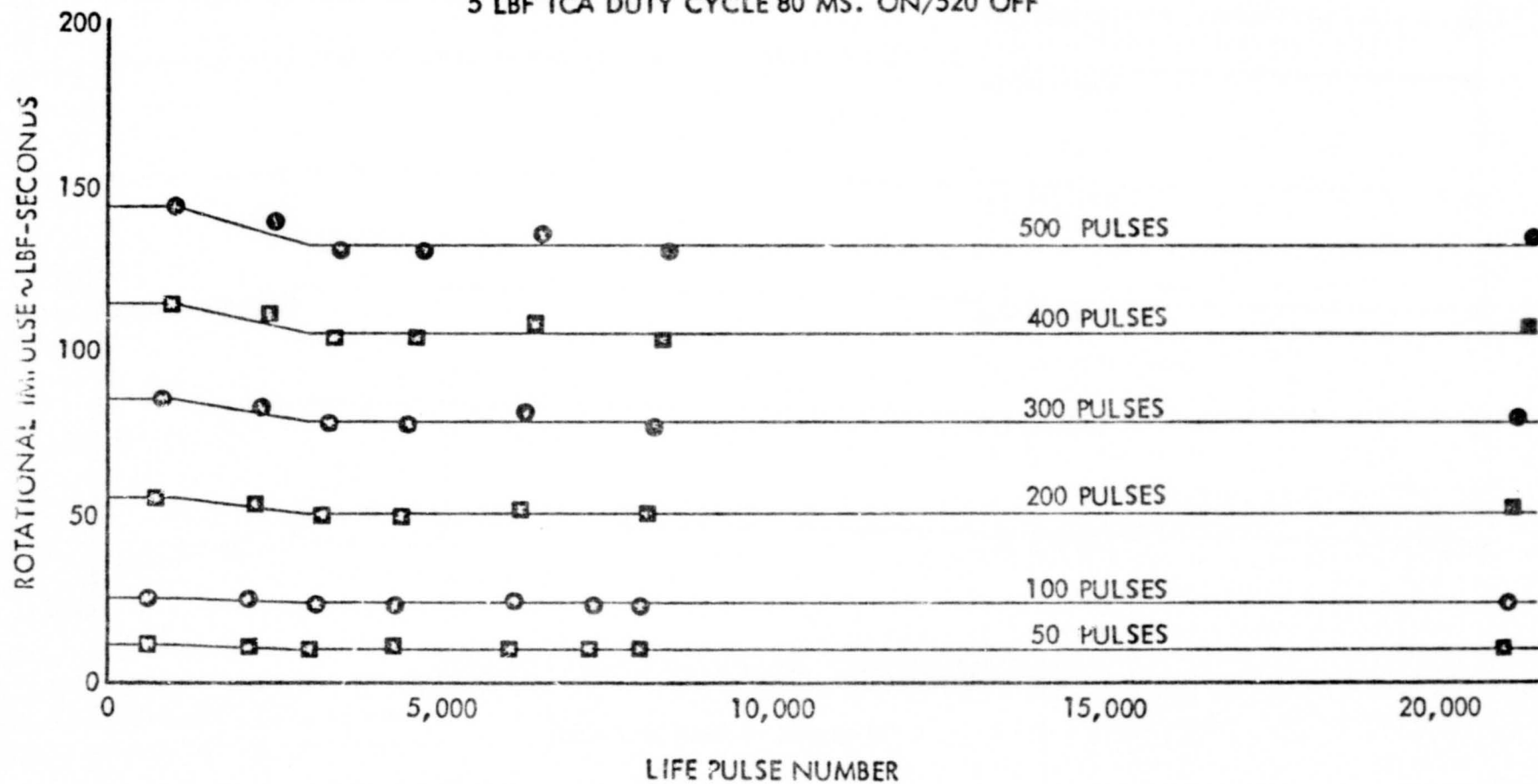
Figure 1



EFFECT OF LIFE ON ROTATIONAL IMPULSE

FEED PRESSURE = 180 PSIA

5 LBF TCA DUTY CYCLE 80 MS. ON/520 OFF



4.3.1-96

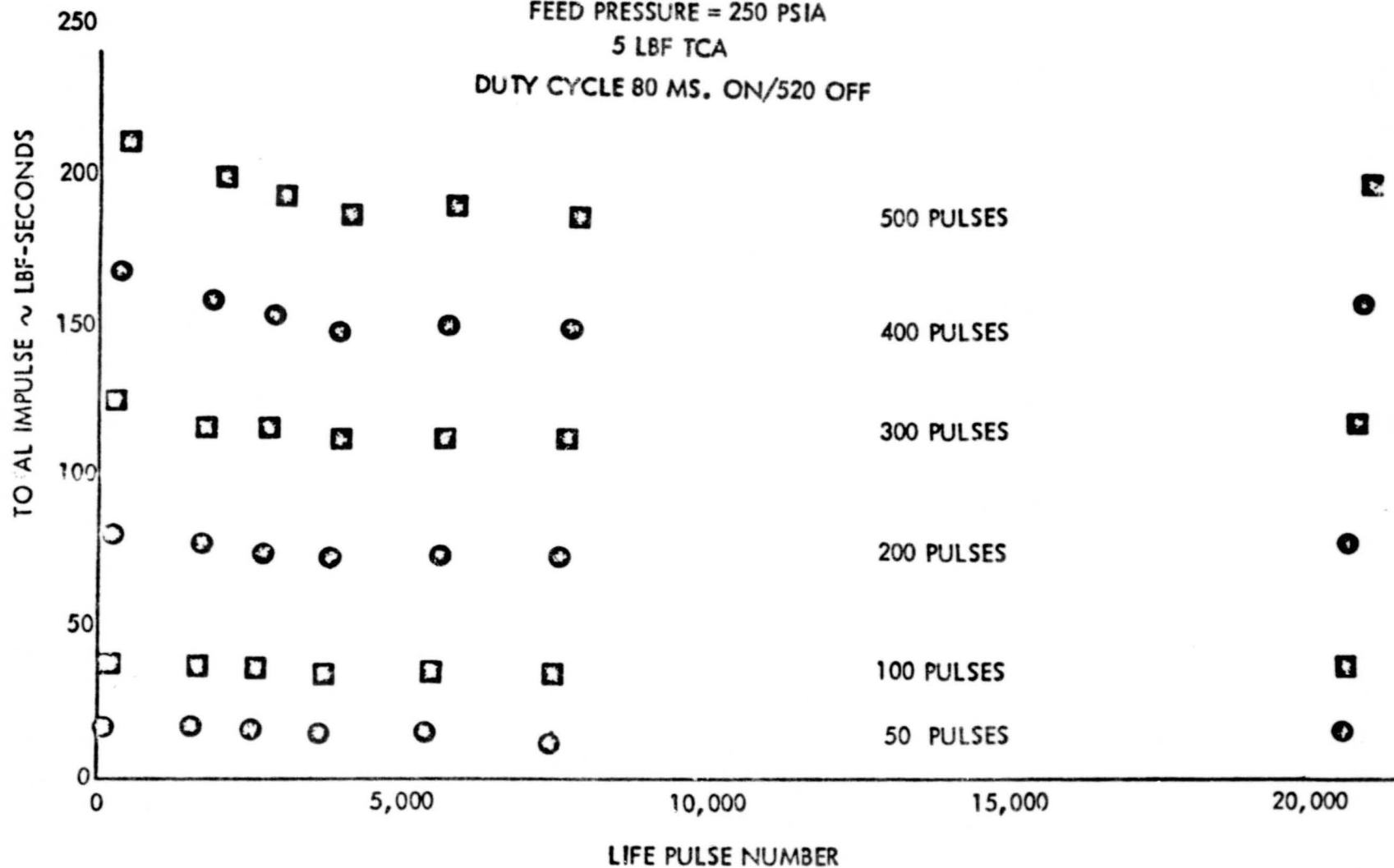
Figure 2

EFFECT OF LIFE ON TOTAL IMPULSE

FEED PRESSURE = 250 PSIA

5 LBF TCA

DUTY CYCLE 80 MS. ON/520 OFF



4.3.1-97

Figure 3

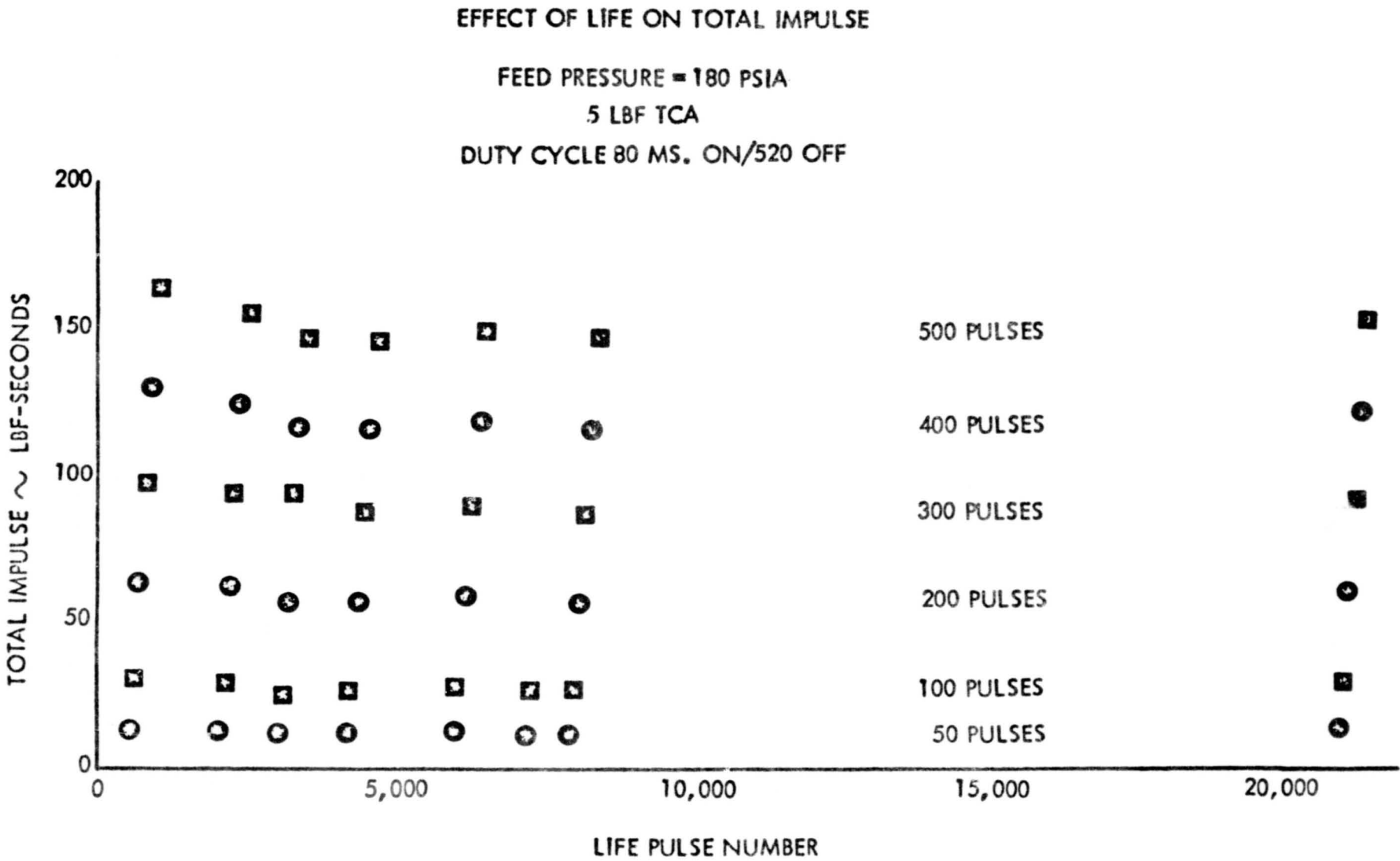


Figure 4

4.3.1-98

97

C2

EFFECT OF FEED PRESSURE ON
ROTATIONAL CENTROID
5.0 lbf TCA

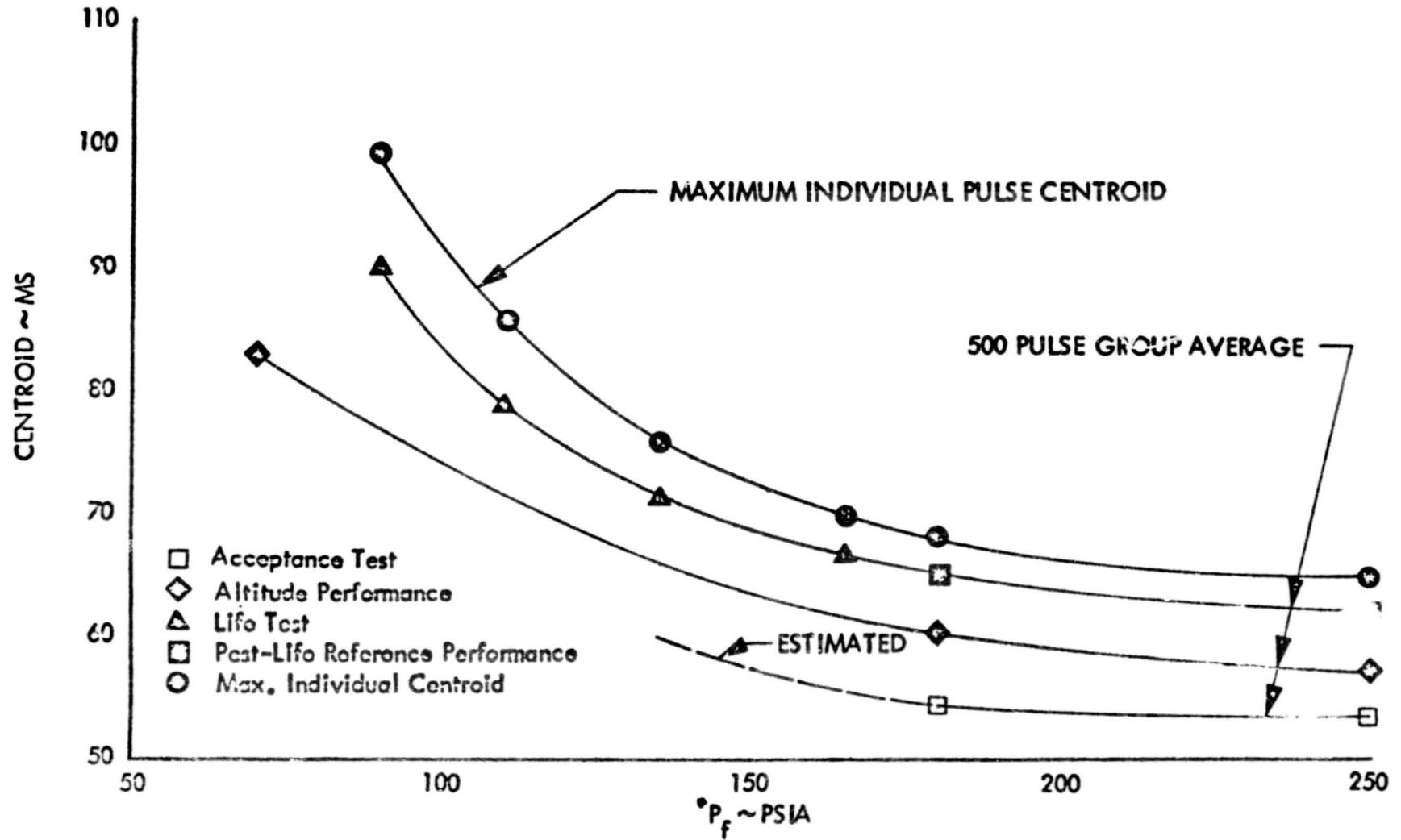


Figure 5

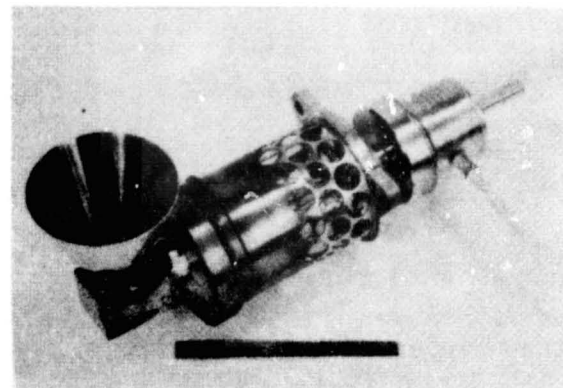
ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE

MANUFACTURER Hamilton Standard (32)

MODEL NO. R.E.A. 22-5

PART NUMBER SV 748563



REA 22-5

VALVE MANUFACTURER..... Parker Aircraft PART NUMBER 5720003

HEATER MANUFACTURER..... TSI PART NUMBER 76-3763

SENSOR MANUFACTURERS.....

TEMPERATURE TRANSDUCER TSI PART NUMBER 5148-4

PRESSURE TRANSDUCER PART NUMBER _____

PROGRAM..... Classified

CONTRACTING AGENCY Air Force

PRIME CONTRACTOR LMSC

STATUS

QUALIFIED _____

FLOWN Yes

LAUNCH VEHICLE _____

AVAILABILITY Production status

COST/PROCUREMENT INFORMATION... _____

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4.3.1-101

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE

PROPELLANT..... N_2H_4

VACUUM THRUST RANGE 44-62 N (10-14 lbf)

INLET PRESSURE RANGE 117-176 N/cm² (170-255 PSIA)

INLET TEMPERATURE RANGE 4 to 43 °C (40 to 110 °F)

MINIMUM IMPULSE BIT 0.7 N-sec @ 145 N/cm² INLET P, 620 °C CATALYST BED TEMP.
(.16 lbf-sec @ 210 PSIA, 1150 °F CATALYST BED TEMP)

IMPULSE BIT REPEATABILITY @ 145 N/cm² (210 PSIA) INLET PRESSURE:
3σ REPEATABILITY PULSE NUMBER
Unit-to-unit Pulse Train can Equilibrium
be improved by tighter thrust Pulsing
control. ± 10 %
± %
± %

CENTROID LOCATION REPEATABILITY FOR _____ sec VALVE ON-TIME:
3σ REPEATABILITY PULSE NUMBER
± %
± %
± %

CHAMBER PRESSURE ROUGHNESS ± %

RESPONSE -
TIME FROM VALVE-ON SIGNAL TO 90% STEADY STATE P_c: _____ sec
TIME FROM VALVE-OFF SIGNAL TO 10% STEADY STATE P_c: _____ sec

STEADY STATE VACUUM SPECIFIC IMPULSE 2275 N-sec/kg (232 lbf-sec/lbm)

LIFE -
TOTAL IMPULSE 162,360 N-sec (36,500 lbf-sec)
TOTAL THROUGHPUT 76.6 kg (160 lbm)
TOTAL NUMBER OF COLD STARTS 122 @ 32 °C (90 °F)
TOTAL NUMBER OF PULSES..... 138,000

STEADY STATE DUTY CYCLE -
TOTAL ON-TIME 1900 sec
MAXIMUM ON-TIME 60 sec

PULSE MODE DUTY CYCLE -
TEMPERATURE AT START OF PULSE TRAIN 32 °C (90 °F)
NOMINAL PULSE TRAIN LENGTH Variable PULSES
NOMINAL ON-TIME(S)015 sec
NOMINAL OFF-TIME(S) Variable sec

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE continued

P/N SV 748563

LAUNCH ENVIRONMENT -

RANDOM VIBRATION -

WIDE BAND LEVEL

13.9 G_{rms}

MAX POWER SPECTRAL DENSITY

1.0 G^2/Hz from 20 to 25 Hz

SINUSOIDAL VIBRATION -

SWEEP RATE

3 OCTAVES/min

MAX G LEVEL (0-PEAK)

.5 AT 5-14 Hz

5 AT 14-400 Hz

7.5 AT 400- Hz

2000

ACOUSTIC VIBRATION -

OVERALL SOUND PRESSURE LEVEL

_____ dB FOR _____ MINUTES

SHOCK RESPONSE -

WAVE FORM PEAK-LEVEL OF

40 G's FOR 8M sec

SHOCK SPECTRUM-PEAK RESPONSE OF

_____ G's AT _____ Hz

AMPLIFICATION FACTOR (Q)

STATIC ACCELERATION

6.0 G's

INJECTOR -

PATTERN OF PROPELLANT DISTRIBUTION

Multi-element, Penetrating injector

INJECTOR PRESSURE DROP AT FLOW RATE

63.4 li/cm^2 @ .023 kg/sec

(92 PSID @ .05 lbm/sec)

CATALYST -

TYPE

Shell 405 ABSG

PELLET SIZE(S)

20-30, 14-18

RETENTION TECHNIQUE

Mid-Screen & end retainer

BED DIAMETER

4.2 cm (1.642 in)

BED LENGTH

1.6 cm (.625 in)

BED LOADING

.0014- kg/sec/cm² (.02-.03 lbm/sec/in²)

.0021

HEATER -

NOMINAL SUPPLY VOLTAGE

24.5 Vdc,

MAXIMUM POWER

4.8 WATTS @ 29.5 Vdc, _____ °C (_____ °F)

CATALYST BED TEMPERATURE

32 °C (90 °F)

VALVE -

THRUSTER-VALVE INTERFACE DESCRIPTION

PROOF PRESSURE

483 N/cm² (700 PSIA)

BURST PRESSURE

645 N/cm² (935 PSIA)

EXTERNAL LEAKAGE

1 x 10⁻⁶ sec/s OF He @ 207 N/cm² (300 PSIA)

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.1 THRUSTER, HYDRAZINE continued

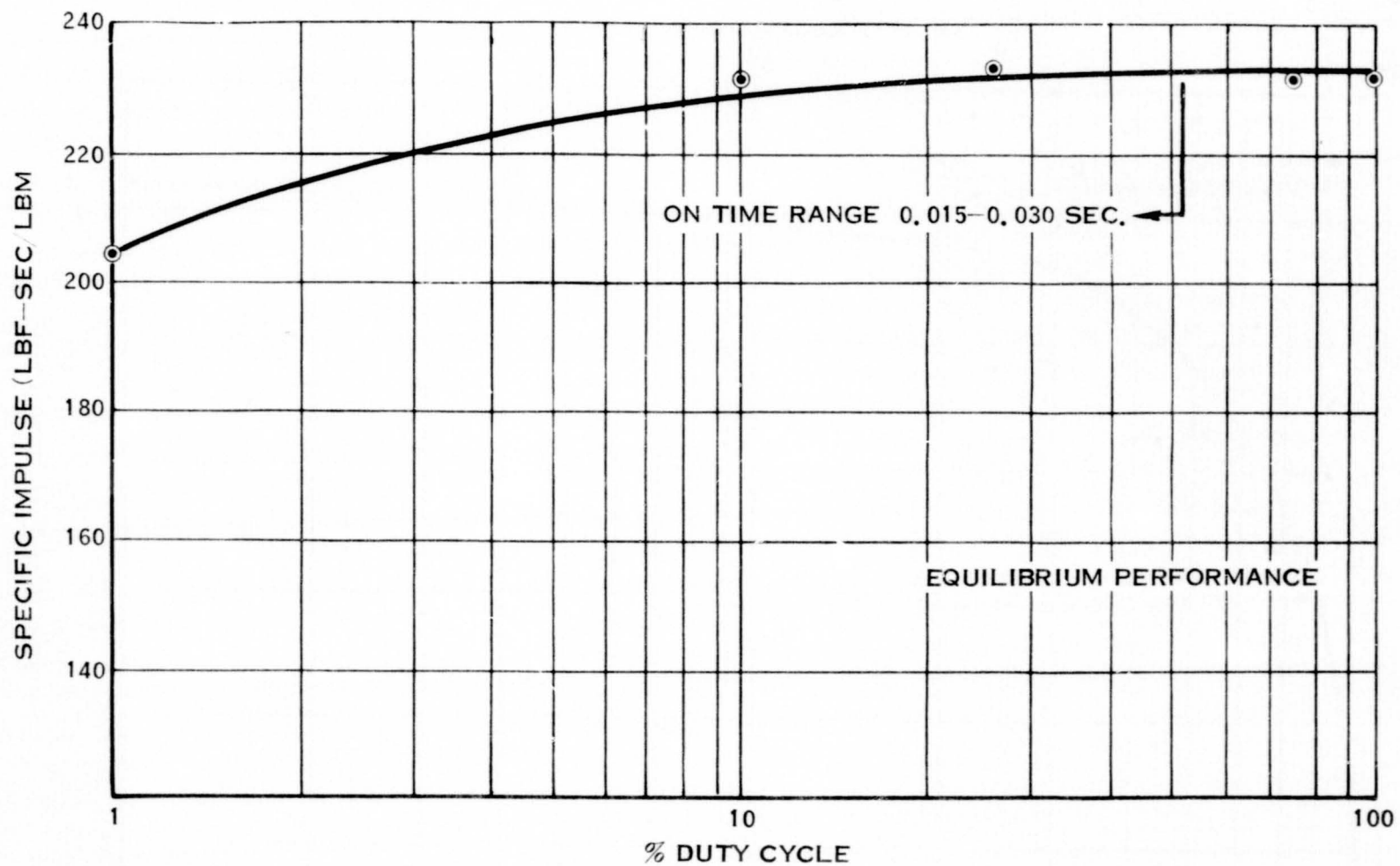
MATERIAL -

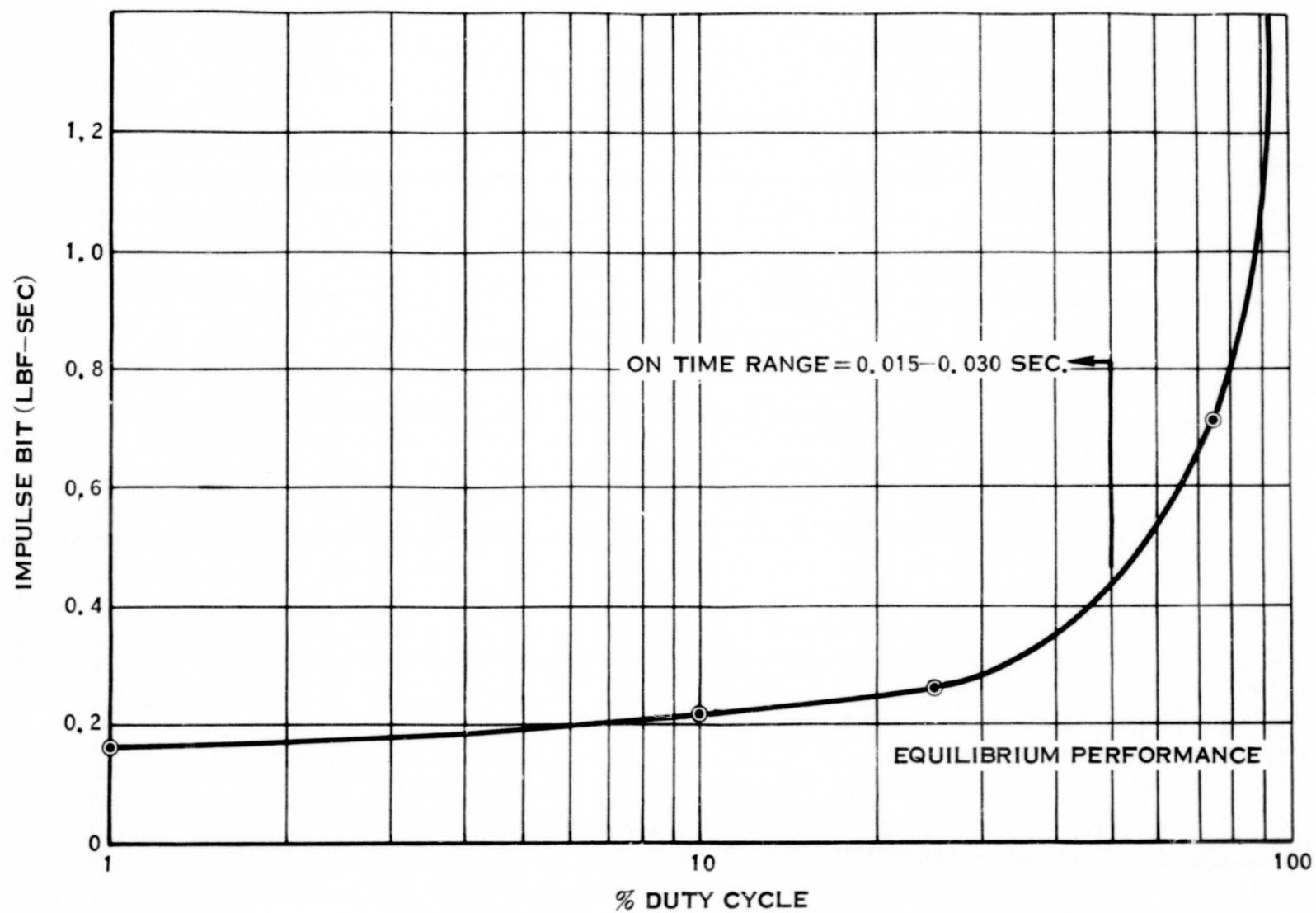
CHAMBER	<u>Inconel 600</u>
STANDOFF	<u>Inconel 600</u>
CATALYST RETAINER	<u>L-605 (Haynes 25)</u>

MASS -

WITH VALVE	<u>.635</u> kg	(<u>1.4</u> lbm)
WITHOUT VALVE	_____ kg	(_____ lbm)
OTHER	_____ kg	(_____ lbm)

OTHER SIGNIFICANT CHARACTERISTICS





ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.2 VALVE, HYDRAZINE THRUSTER

MANUFACTURER Wright Components, Inc. (23)

PART NUMBER 15617-4

PROGRAM..... CTS, Experimental Broadcast Satellite
(Japanese)

CONTRACTING AGENCY.....

PRIME CONTRACTOR..... Hamilton Standard

STATUS

QUALIFIED..... yes

FLOWN.....

LAUNCH VEHICLE.....

AVAILABILITY..... 18-24 weeks

COST/PROCUREMENT INFORMATION...

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.2 VALVE, HYDRAZINE THRUSTER

TYPE Co-axial, solenoid
 USED WITH THRUSTER Hamilton Standard 0.1#N₂H₄ Thruster
 DESIGN FLOW MEDIA N₂H₄
 RATED FLOW AT PRESSURE DIFFERENTIAL0002 kg/ser @ 3 N/cm², _____ °C
 (0.0005 lbm/sec @ 5 PSID, _____ °F)
 RESPONSE TIME -
 OPEN 8 ms @ _____ Vdc, _____ N/cm² INLET PRESSURE _____ °C
 (_____ PSIA INLET PRESSURE _____ °F)
 CLOSE 10 ms @ _____ Vdc, _____ N/cm², _____ °C
 (_____ PSIA _____ °F)
 LIFE 1 x 10⁶ CYCLES
 INTEGRAL FILTRATION None MICRONS ABSOLUTE
 PRESSURES -
 OPERATING INLET RANGE 273 N/cm² (396 PSIA)
 PROOF 409 N/cm² (594 PSIA)
 BURST 1092 N/cm² (1584 PSIA)
 OPERATING TEMPERATURE RANGE 10-93.3 °C ambient (50-200 °F)
 LEAKAGE - 7.2 -93.3 fluid (45-200 °F)
 INTERNAL07 scc/hr OF He @ 282 N/cm²
 (410 PSIA)
 EXTERNAL 1 x 10⁻⁶ scc/s OF He @ _____ N/cm²
 (_____ PSIA)
 SUPPLY VOLTAGE RANGE 25-29 Vdc
 POWER REQUIREMENTS 5 WATTS @ 29 Vdc, 7.22 °C (45 °F)
 DIELECTRIC STRENGTH 5 mA MAXIMUM CURRENT LEAKAGE
 @ 600 VOLTS rms, 60 Hz
 INSULATION RESISTANCE 50 MΩ @ 100 Vdc
 MAX. VALVE MAGNETIC FIELD DENSITY -
 ENERGIZED _____ nT @ 1 m (_____ GAMMA @ 6 in)
 DE-ENERGIZED _____ nT @ 1 m (_____ GAMMA @ 6 in)
 MATERIAL -
 CONSTRUCTION Stainless steel
 SEATS AFE-102
 MASS0771 kg (0.170 lbm)
 OTHER SIGNIFICANT CHARACTERISTICS

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.2 VALVE, HYDRAZINE THRUSTER

MANUFACTURER Wright Components, Inc. (23)

PART NUMBER 15548

PROGRAM..... Solrad X

CONTRACTING AGENCY.....

PRIME CONTRACTOR..... Naval Research Lab

STATUS

QUALIFIED..... yes

FLOWN..... yes

LAUNCH VEHICLE.....

AVAILABILITY..... 18-24 weeks ARO

COST/PROCUREMENT INFORMATION...

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.2 VALVE, HYDRAZINE THRUSTER

TYPE Co-axial, solenoid
 USED WITH THRUSTER Ham. Std. 0.1#N₂H₄ Thruster; Avco Ammonia Thruster
 DESIGN FLOW MEDIA Hydrazine or Ammonia
 RATED FLOW AT PRESSURE DIFFERENTIAL ... kg/sec @ N/cm², °C
 (lbm/sec @ PSID, °F)
 RESPONSE TIME - equiv. to 0.018in dia. (C_d = 0.8)
 OPEN 15 ms @ 24 Vdc, N/cm² INLET PRESSURE °C
 (PSIA INLET PRESSURE °F)
 CLOSE 15 ms @ 24 Vdc, N/cm², °C
 (PSIA °F)
 LIFE 2 X 10⁶ CYCLES
 INTEGRAL FILTRATION None MICRONS ABSOLUTE
 PRESSURES -
 OPERATING INLET RANGE 0-251 N/cm² (0-365 PSIA)
 PROOF 320 N/cm² (465 PSIA)
 BURST 527 N/cm² (765 PSIA)
 OPERATING TEMPERATURE RANGE 0 to 60 °C (32 to 140 °F)
 LEAKAGE -
 INTERNAL07 scc/hr OF He @ N/cm²
 (PSIA)
 EXTERNAL 2 X 10⁻⁶ scc/s OF He @ N/cm²
 (PSIA)
 SUPPLY VOLTAGE RANGE 22-26 Vdc
 POWER REQUIREMENTS 3 WATTS @ 24 Vdc, 24 °C (76 °F)
 DIELECTRIC STRENGTH 50 mA MAXIMUM CURRENT LEAKAGE
 @ 500 VOLTS rms, 60 Hz
 INSULATION RESISTANCE 10 MΩ @ 100 Vdc
 MAX. VALVE MAGNETIC FIELD DENSITY -
 ENERGIZED nT @ 1 m (GAMMA @ 6 in)
 DE-ENERGIZED nT @ 1 m (GAMMA @ 6 in)
 MATERIAL -
 CONSTRUCTION Stainless steel
 SEATS AFE 102; EPR 515-8
 MASS 0.13 kg (0.30 lbm)
 OTHER SIGNIFICANT CHARACTERISTICS

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.2 VALVE, HYDRAZINE THRUSTER

MANUFACTURER Allen Design, Inc. (27)

PART NUMBER 13880

PROGRAM..... Aerobee

CONTRACTING AGENCY.....

PRIME CONTRACTOR..... Aerojet Mfg.

STATUS

QUALIFIED.....

FLOWN..... Yes

LAUNCH VEHICLE.....

AVAILABILITY.....

COST/PROCUREMENT INFORMATION... One - \$565

100 - \$285

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.2 VALVE, HYDRAZINE THRUSTER

TYPE Solenoid valve - normally closed
 USED WITH THRUSTER
 DESIGN FLOW MEDIA
 RATED FLOW AT PRESSURE DIFFERENTIAL00042 kg/sec @ 93 N/cm², _____ °C
 (.00093 lbm/sec @ 135 PSID, _____ °F)
 RESPONSE TIME -
 OPEN 10 ms @ 24 Vdc, 117 N/cm² INLET PRESSURE 20 °C
 (170 PSIA INLET PRESSURE 68 °F)
 CLOSE 10 ms @ 32 Vdc, 44 N/cm², 20 °C
 (65 PSIA 68 °F)
 LIFE 100,000 CYCLES
 INTEGRAL FILTRATION _____ MICRONS ABSOLUTE
 PRESSURES -
 OPERATING INLET RANGE 0-117 N/cm² (0-170 PSIA)
 PROOF 527 N/cm² (765 PSIA)
 BURST 699 N/cm² (1015 PSIA)
 OPERATING TEMPERATURE RANGE -42 to +71 °C (-45 to +160 °F)
 LEAKAGE -
 INTERNAL 6 scc/hr OF He @ _____ N/cm²
 (_____ PSIA)
 EXTERNAL None scc/s OF _____ N/cm²
 (_____ PSIA)
 SUPPLY VOLTAGE RANGE 22-32 Vdc
 POWER REQUIREMENTS _____ WATTS @ _____ Vdc, _____ °C (_____ °F)
 DIELECTRIC STRENGTH _____ mA MAXIMUM CURRENT LEAKAGE
 @ _____ VOLTS rms, _____ Hz
 INSULATION RESISTANCE _____ MΩ @ _____ Vdc
 MAX. VALVE MAGNETIC FIELD DENSITY -
 ENERGIZED _____ nT @ 1 m (_____ GAMMA @ 6 in)
 DE-ENERGIZED _____ nT @ 1 m (_____ GAMMA @ 6 in)
 MATERIAL -
 CONSTRUCTION
 SEATS
 MASS 0.13 kg (0.30 lbm)
 OTHER SIGNIFICANT CHARACTERISTICS
 May be used with cold gas and hydrazine.

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.2 VALVE, HYDRAZINE THRUSTER

MANUFACTURER Allen Design, Inc. (27)

PART NUMBER 13899

PROGRAM.....

CONTRACTING AGENCY.....

PRIME CONTRACTOR..... Rocket Research Corp.

STATUS

QUALIFIED.....

FLOWN..... Yes

LAUNCH VEHICLE.....

AVAILABILITY.....

COST/PROCUREMENT INFORMATION... One - \$685

100 - \$340

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.2 VALVE, HYDRAZINE THRUSTER

TYPE Solenoid valve - normally closed

USED WITH THRUSTER _____

DESIGN FLOW MEDIA N₂H₄

RATED FLOW AT PRESSURE DIFFERENTIAL0010 kg/sec @ 3.4 N/cm², _____ °C
(.0023 lbm/sec @ 5.0 PSID, _____ °F)

RESPONSE TIME -

OPEN 15 ms @ 24 Vdc, 182 N/cm² INLET PRESSURE 20 °C
(265 PSIA INLET PRESSURE 68 °F)

CLOSE 15 ms @ 30 Vdc, 86 N/cm², 20 °C
(125 PSIA 68 °F)

LIFE 100,000 CYCLES

INTEGRAL FILTRATION _____ MICRONS ABSOLUTE

PRESSURES -

OPERATING INLET RANGE 86-182 N/cm² (125-265 PSIA)

PROOF 268 N/cm² (390 PSIA)

BURST 355 N/cm² (515 PSIA)
+71.1 °C +160 °F

OPERATING TEMPERATURE RANGE -40 to °C (-40 to °F)

LEAKAGE -

INTERNAL 29 scc/hr OF GN₂ @ _____ N/cm²
(_____ PSIA)

EXTERNAL 10⁻⁶ scc/s OF He @ 172 N/cm²
(250 PSIA)

SUPPLY VOLTAGE RANGE 15-30 Vdc

POWER REQUIREMENTS 3 WATTS @ 24 Vdc, 21 °C (70 °F)

DIELECTRIC STRENGTH _____ mA MAXIMUM CURRENT LEAKAGE
@ _____ VOLTS rms, _____ Hz

INSULATION RESISTANCE _____ MΩ @ _____ Vdc

MAX. VALVE MAGNETIC FIELD DENSITY -

ENERGIZED _____ nT @ 1 m (_____ GAMMA @ 6 in)

DE-ENERGIZED _____ nT @ 1 m (_____ GAMMA @ 6 in)

MATERIAL -

CONSTRUCTION _____

SEATS _____

MASS 0.13 kg (0.30 lbm)

OTHER SIGNIFICANT CHARACTERISTICS

Valve may be used with cold gases or hydrazine.

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OF POOR QUALITY

4.3.2-8

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ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.2 VALVE, HYDRAZINE THRUSTER

MANUFACTURER Wright Components Corp. (23)

PART NUMBER 15676

PROGRAM..... Solrad X 1 & Classified Program

CONTRACTING AGENCY..... Naval Research Labs

PRIME CONTRACTOR..... Hamilton Standard

STATUS

QUALIFIED..... yes

FLOWN..... due in 1975

LAUNCH VEHICLE..... _____

AVAILABILITY..... 18-24 weeks ARO

COST/PROCUREMENT INFORMATION... _____

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.2 VALVE, HYDRAZINE THRUSTER

TYPE Co-axial solenoid operated
 USED WITH THRUSTER Hamilton Standard 5#N₂H₄ Thruster P/N SV755436
 DESIGN FLOW MEDIA N₂H₄
 RATED FLOW AT PRESSURE DIFFERENTIAL ... _____ kg/sec @ _____ N/cm², _____ °C
 (_____ lbm/sec @ _____ PSID, _____ °F)
 RESPONSE TIME - equiv. to 0.043 dia orifice (C_d = .65)
 OPEN 10 ms @ 24 Vdc, 206 N/cm² INLET PRESSURE _____ °C
 (300 PSIA INLET PRESSURE _____ °F)
 CLOSE 10 ms @ 24 Vdc, 206 N/cm², _____ °C
 (300 PSIA _____ °F)
 LIFE 1 X 10⁶ CYCLES
 INTEGRAL FILTRATION None MICRONS ABSOLUTE
 PRESSURES -
 OPERATING INLET RANGE 206 N/cm² (0-300 PSIA)
 PROOF 413 N/cm² (600 PSIA)
 BURST 620 N/cm² (900 PSIA)
 OPERATING TEMPERATURE RANGE -10 to 121 °C ambient (14-250 °F)
-10 to 60 fluid (14-140 °F)
 LEAKAGE -
 INTERNAL053 scc/hr OF He @ 78.6 N/cm²
 (114 PSIA)
 EXTERNAL 1.0 X 10⁻⁶ scc/s OF He @ 78.6 N/cm²
 (114 PSIA)
 SUPPLY VOLTAGE RANGE 24-32 Vdc
 POWER REQUIREMENTS 10 WATTS @ 28 Vdc, 24 °C (76 °F)
 DIELECTRIC STRENGTH 50 mA MAXIMUM CURRENT LEAKAGE
 @ 500 VOLTS DC, _____ Hz
 INSULATION RESISTANCE 10 MΩ @ 500 Vdc
 MAX. VALVE MAGNETIC FIELD DENSITY -
 ENERGIZED _____ nT @ 1 m (_____ GAMMA @ 6 in)
 DE-ENERGIZED _____ nT @ 1 m (_____ GAMMA @ 6 in)
 MATERIAL -
 CONSTRUCTION Stainless steel
 SEATS AFE - 102
 MASS 0.2 kg (0.5 lbm)
 OTHER SIGNIFICANT CHARACTERISTICS Valve shall actuate @ 16Vdc @ 300 psid @ 250°F
 to insure adequate force margin

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.2 VALVE, HYDRAZINE THRUSTER

MANUFACTURER Moog, Inc. (35)

PART NUMBER 50-399

PROGRAM..... P-95

CONTRACTING AGENCY.....

PRIME CONTRACTOR..... Rocket Research Corp.

STATUS

QUALIFIED..... Yes

FLOWN..... Yes

LAUNCH VEHICLE.....

AVAILABILITY.....

COST/PROCUREMENT INFORMATION...

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.2 VALVE, HYDRAZINE THRUSTER

TYPE Solenoid operated mono. single seat,
single coil
 USED WITH THRUSTER
 DESIGN FLOW MEDIA N₂H₄
 RATED FLOW AT PRESSURE DIFFERENTIAL005303 kg/sec @ 10 N/cm², _____ °C
 (.01169 lbm/sec @ 15 PSID, _____ °F)
 RESPONSE TIME -
 OPEN 6±1.0 ms @ 24 Vdc, 158 N/cm² INLET PRESSURE 121 °C
 (230 PSIA INLET PRESSURE 250 °F)
 CLOSE 4±1.0 ms @ 33 Vdc, 68.9 N/cm², 1.6 °C
 (100 PSIA 35 °F)
 LIFE 10⁶ CYCLES
 INTEGRAL FILTRATION _____ MICRONS ABSOLUTE
 PRESSURES -
 OPERATING INLET RANGE 217 N/cm² (315 PSIA)
 PROOF 424 N/cm² (615 PSIA)
 BURST 837.7 N/cm² (1215 PSIA)
 (148 300)
 OPERATING TEMPERATURE RANGE +1.6 to °C (+35 to °F)
 LEAKAGE -
 INTERNAL 1.0 scc/hr OF N₂ @ 15-217 N/cm²
 (0-315 PSIA)
 EXTERNAL 0 Bubble scc/s OF GN₂ @ _____ N/cm²
 (_____ PSIA)
 SUPPLY VOLTAGE RANGE 20-33 Vdc
 POWER REQUIREMENTS _____ WATTS @ _____ Vdc, _____ °C (_____ °F)
 DIELECTRIC STRENGTH _____ mA MAXIMUM CURRENT LEAKAGE
 @ _____ VOLTS rms, _____ Hz
 INSULATION RESISTANCE _____ MΩ @ _____ Vdc
 MAX. VALVE MAGNETIC FIELD DENSITY -
 ENERGIZED _____ nT @ 1 m (_____ GAMMA @ 6 in)
 DE-ENERGIZED _____ nT @ 1 m (_____ GAMMA @ 6 in)
 MATERIAL -
 CONSTRUCTION Cres, Teflon Seal
 SEATS
 MASS 0.15 kg (0.35 lbm)
 OTHER SIGNIFICANT CHARACTERISTICS

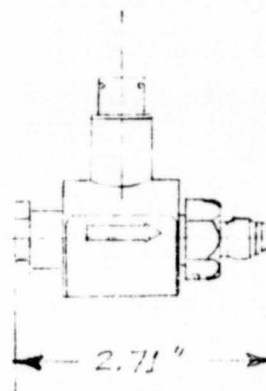
No sliding surfaces. All welded construction.

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.2 VALVE, HYDRAZINE THRUSTER

MANUFACTURER Eckel Valve Co. (58)

PART NUMBER AF56C-279



PROGRAM..... FAIR II

CONTRACTING AGENCY..... _____

PRIME CONTRACTOR..... Philco Ford

STATUS

QUALIFIED..... Yes

FLOWN..... Yes

LAUNCH VEHICLE..... _____

AVAILABILITY..... _____

COST/PROCUREMENT INFORMATION... _____

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.2 VALVE, HYDRAZINE THRUSTER

TYPE Thrust control, solenoid, shut off

USED WITH THRUSTER _____

DESIGN FLOW MEDIA N₂H₄ MIL-P-26536C

RATED FLOW AT PRESSURE DIFFERENTIAL ...
Equiv. orifice .070 diam.
(CD=.65) kg/sec @ _____ N/cm², _____ °C
(_____ lbm/sec @ _____ PSID, _____ °F)

RESPONSE TIME -

OPEN010 sec @ 24 Vdc, _____ N/cm² INLET PRESSURE _____ °C
(_____ PSIA INLET PRESSURE _____ °F)

CLOSE010 sec @ 24 Vdc, _____ N/cm², _____ °C
(_____ PSIA _____ °F)

LIFE 5000 CYCLES

INTEGRAL FILTRATION _____ MICRONS ABSOLUTE

PRESSURES -

OPERATING INLET RANGE 217 N/cm² (315 PSIA)

PROOF 320 N/cm² (465 PSIA)

BURST 475 N/cm² (690 PSIA)

OPERATING TEMPERATURE RANGE +4.4 to 73 °C (+40 to 165 °F)

LEAKAGE -

INTERNAL 0.5 scc/hr OF GN₂ @ 206 N/cm²
(300 PSIA)

EXTERNAL 0 scc/s OF _____ @ 0-217 N/cm²
(0-315 PSIA)

SUPPLY VOLTAGE RANGE 22-28 Vdc

POWER REQUIREMENTS 1.4 amps WATTS @ 28 Vdc, 21 °C (70 °F)

DIELECTRIC STRENGTH _____ mA MAXIMUM CURRENT LEAKAGE
@ _____ VOLTS rms, _____ Hz

INSULATION RESISTANCE _____ MΩ @ _____ Vdc

MAX. VALVE MAGNETIC FIELD DENSITY -

ENERGIZED _____ nT @ 1 m (_____ GAMMA @ 6 in)

DE-ENERGIZED _____ nT @ 1 m (_____ GAMMA @ 6 in)

MATERIAL -

CONSTRUCTION _____

SEATS _____

MASS _____ kg (_____ lbm)

OTHER SIGNIFICANT CHARACTERISTICS

Suitable for use in Oxygen, Nitrogen & Helium applications.

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.2 VALVE, HYDRAZINE THRUSTER

MANUFACTURER Fairchild Industries
Stratos Division (31)

PART NUMBER 403000

PROGRAM..... Intelsat III

CONTRACTING AGENCY..... _____

PRIME CONTRACTOR..... TRW Systems

STATUS

QUALIFIED..... Yes

FLOWN..... Yes

LAUNCH VEHICLE..... DSV-3M

AVAILABILITY..... Not in production. Available on special order.

COST/PROCUREMENT INFORMATION... _____

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.2 VALVE, HYDRAZINE THRUSTER

TYPE Direct acting solenoid (1 coil, dual seat)*
 USED WITH THRUSTER (Supplied by TRW)
 DESIGN FLOW MEDIA Hydrazine
 RATED FLOW AT PRESSURE DIFFERENTIAL0068 kg/sec @ 48 N/cm², 21 °C
 (0.015 lbm/sec @ 70 PSID, 70 °F)
 RESPONSE TIME -
 OPEN 20 ms @ 25 Vdc, 424 N/cm² INLET PRESSURE 48.8 °C
 (615 PSIA INLET PRESSURE 120 °F)
 CLOSE 20 ms @ 31 Vdc, 93 N/cm², 4.4 °C
 (135 PSIA 40 °F)
 LIFE 60,000 CYCLES
 INTEGRAL FILTRATION _____ MICRONS ABSOLUTE
 PRESSURES -
 OPERATING INLET RANGE 93-424 N/cm² (135-615 PSIA)
 PROOF 630 N/cm² (915 PSIA)
 BURST 837.7 N/cm² (1215 PSIA)
 OPERATING TEMPERATURE RANGE +4.4 to 48.8 °C (-40 to +120 °F)
 LEAKAGE -
 INTERNAL 0.5 scc/hr OF GN₂ @ 424 N/cm²
 (615 PSIA)
 EXTERNAL 3 x 10⁻⁶ scc/s OF He @ 424 N/cm²
 (615 PSIA)
 SUPPLY VOLTAGE RANGE 25-31 Vdc
 POWER REQUIREMENTS 5 WATTS @ 31 Vdc, 4.4 °C (40 °F)
 DIELECTRIC STRENGTH _____ mA MAXIMUM CURRENT LEAKAGE
 @ _____ VOLTS rms, _____ Hz
 INSULATION RESISTANCE _____ MΩ @ _____ Vdc
 MAX. VALVE MAGNETIC FIELD DENSITY -
 ENERGIZED _____ nT @ 1 m (_____ GAMMA @ 6 in)
 DE-ENERGIZED _____ nT @ 1 m (_____ GAMMA @ 6 in)
 MATERIAL -
 CONSTRUCTION Vanadium Permendure (Nichle Plate, 300 Series)
 SEATS Cres
 MASS 0.17 kg (0.38 lbm)
 OTHER SIGNIFICANT CHARACTERISTICS

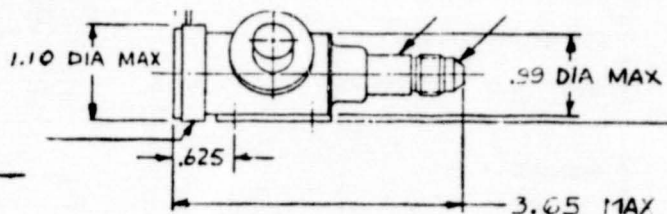
*May be activated by either or both coils.

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.2 VALVE, HYDRAZINE THRUSTER

MANUFACTURER Fairchild Industries
Stratos Division (54)

PART NUMBER (TRW P/N EQ2-379)



PROGRAM..... Atmosphere Explorer

CONTRACTING AGENCY..... NASA/GSFC

PRIME CONTRACTOR..... RCA Astro Electronics Division

STATUS

QUALIFIED..... Yes

FLOWN..... December, 1973

LAUNCH VEHICLE..... Thor Delta

AVAILABILITY.....

COST/PROCUREMENT INFORMATION...

4.3.2 VALVE, HYDRAZINE THRUSTER

4.3.2-18

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.2 VALVE, HYDRAZINE THRUSTER

MANUFACTURER Allen Design, Inc. (27)

PART NUMBER 13987

PROGRAM.....

CONTRACTING AGENCY.....

PRIME CONTRACTOR..... Rocket Research Corp.

STATUS

QUALIFIED.....

FLOWN..... Yes

LAUNCH VEHICLE.....

AVAILABILITY.....

COST/PROCUREMENT INFORMATION... One - \$585

100 - \$395

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.2 VALVE, HYDRAZINE THRUSTER

TYPE Solenoid valve - normally closed
 USED WITH THRUSTER
 DESIGN FLOW MEDIA N_2H_4
 RATED FLOW AT PRESSURE DIFFERENTIAL00707 kg/sec @ _____ N/cm², _____ °C
 (.0156 lbm/sec @ _____ PSID, _____ °F)
 RESPONSE TIME -
 OPEN 20 ms @ 20 Vdc, 34 N/cm² INLET PRESSURE 20 °C
 (50 PSIA INLET PRESSURE 68 °F)
 CLOSE 20 ms @ 32 Vdc, 34 N/cm², 20 °C
 (50 PSIA 68 °F)
 LIFE 5,000,000 CYCLES
 INTEGRAL FILTRATION _____ MICRONS ABSOLUTE
 PRESSURES -
 OPERATING INLET RANGE 0-99 N/cm² (0-145 PSIA)
 PROOF 630 N/cm² (915 PSIA)
 BURST 1044 N/cm² (1515 PSIA)
 OPERATING TEMPERATURE RANGE -17 to +71.1 °C (0 to 160 °F)
 LEAKAGE -
 INTERNAL 0.5 scc/hr OF GN₂ @ _____ N/cm²
 (_____ PSIA)
 EXTERNAL 1 x 10⁻⁷ scc/s OF CHe @ _____ N/cm²
 (_____ PSIA)
 SUPPLY VOLTAGE RANGE 23-32 Vdc
 POWER REQUIREMENTS _____ WATTS @ _____ Vdc, _____ °C (_____ °F)
 DIELECTRIC STRENGTH _____ mA MAXIMUM CURRENT LEAKAGE
 @ _____ VOLTS rms, _____ Hz
 INSULATION RESISTANCE _____ MΩ @ _____ Vdc
 MAX. VALVE MAGNETIC FIELD DENSITY -
 ENERGIZED _____ nT @ 1 m (_____ GAMMA @ 6 in)
 DE-ENERGIZED _____ nT @ 1 m (_____ GAMMA @ 6 in)
 MATERIAL -
 CONSTRUCTION
 SEATS
 MASS 0.22 kg (0.50 lbm)
 OTHER SIGNIFICANT CHARACTERISTICS

Valve may be used with cold gas or hydrazine.

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.2 VALVE, HYDRAZINE THRUSTER

MANUFACTURER Moog, Inc. (35)

PART NUMBER 50-441



PROGRAM..... Japanese 'N' Launch Vehicle

CONTRACTING AGENCY..... _____

PRIME CONTRACTOR..... TRW Systems

STATUS

QUALIFIED..... Yes

FLOWN..... _____

LAUNCH VEHICLE..... _____

AVAILABILITY..... _____

COST/PROCUREMENT INFORMATION... _____

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.2 VALVE, HYDRAZINE THRUSTER

TYPE Solenoid operated mono., single seat, single coil
 USED WITH THRUSTER
 DESIGN FLOW MEDIA N_2H_4
 RATED FLOW AT PRESSURE DIFFERENTIAL ... 0.009 kg/sec @ 6.8 N/cm², _____ °C
 (0.02 lbm/sec @ 10 PSID, _____ °F)
 RESPONSE TIME -
 OPEN 8 ms @ 23 Vdc, 227 N/cm² INLET PRESSURE 25 °C
 (330 PSIA INLET PRESSURE 77 °F)
 CLOSE 5 ms @ 33 Vdc 199 N/cm², 25 °C
 (290 PSIA 77 °F)
 LIFE 10⁶ CYCLES
 INTEGRAL FILTRATION MICRONS ABSOLUTE
 PRESSURES -
 OPERATING INLET RANGE 286 N/cm² (415 PSIA)
 PROOF 424 N/cm² (615 PSIA)
 BURST 837 N/cm² (1215 PSIA)
 OPERATING TEMPERATURE RANGE +4.4 to +93.3 °C (+40 to +200 °F)
 LEAKAGE -
 INTERNAL 5 scc/hr OF GN₂ @ 286 N/cm²
 (415 PSIA)
 EXTERNAL 1 x 10⁻⁷ scc/s OF He @ 286 N/cm²
 (415 PSIA)
 SUPPLY VOLTAGE RANGE 25-31 Vdc
 POWER REQUIREMENTS WATTS @ _____ Vdc, _____ °C (_____ °F)
 DIELECTRIC STRENGTH mA MAXIMUM CURRENT LEAKAGE
 @ _____ VOLTS rms, _____ Hz
 INSULATION RESISTANCE MΩ @ _____ Vdc
 MAX. VALVE MAGNETIC FIELD DENSITY -
 ENERGIZED nT @ 1 m (_____ GAMMA @ 6 in)
 DE-ENERGIZED nT @ 1 m (_____ GAMMA @ 6 in)
 MATERIAL -
 CONSTRUCTION Cres and Teflon seals
 SEATS
 MASS 0.19 kg (0.44 lbm)
 OTHER SIGNIFICANT CHARACTERISTICS

No sliding surfaces. All welded construction.

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.2 VALVE, HYDRAZINE THRUSTER

MANUFACTURER Hydraulic Research (54)

PART NUMBER 48002330
(HM/STD P/N SV748703-1)

PROGRAM..... Transit Improvement (TIP II)

CONTRACTING AGENCY..... APL/JHU

PRIME CONTRACTOR..... RCA Astro Electronics

STATUS

QUALIFIED..... Yes, on Intelsat IV

FLOWN.....

LAUNCH VEHICLE.....

AVAILABILITY.....

COST/PROCUREMENT INFORMATION...

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.2 VALVE, HYDRAZINE THRUSTER

TYPE Torque motor single seat
 USED WITH THRUSTER Hamilton Standard 5 lbf P/N SV755458-1
 DESIGN FLOW MEDIA N₂H₄
 RATED FLOW AT PRESSURE DIFFERENTIAL011 kg/sec @ 4.8 N/cm², 21 °C
 (.025 lbfm/sec @ 7.0 PSID, 70 °F)
 RESPONSE TIME -
 OPEN 7 ms @ 19 Vdc, 227 N/cm² INLET PRESSURE 21 °C
 (330 PSIA INLET PRESSURE 70 °F)
 CLOSE 25 ms @ 19 Vdc, 227 N/cm², 21 °C
 (330 PSIA 70 °F)
 LIFE 5000 CYCLES
 INTEGRAL FILTRATION 25 MICRONS ABSOLUTE
 PRESSURES -
 OPERATING INLET RANGE 227 N/cm² (330 PSIA)
 PROOF 361 N/cm² (525 PSIA)
 BURST 827.3 N/cm² (1200 PSIA)
 OPERATING TEMPERATURE RANGE 5 to 50 °C (41 to 122 °F)
 LEAKAGE -
 INTERNAL 5.0 scc/hr OF N₂ @ 227 N/cm²
 (330 PSIA)
 EXTERNAL 1x10⁻⁶ scc/s OF He @ 227 N/cm²
 (330 PSIA)
 SUPPLY VOLTAGE RANGE 13-19 Vdc
 POWER REQUIREMENTS 12.5 WATTS @ 19 Vdc, 21 °C (70 °F)
 DIELECTRIC STRENGTH _____ mA MAXIMUM CURRENT LEAKAGE
 @ _____ VOLTS rms, _____ Hz
 INSULATION RESISTANCE _____ MΩ @ _____ Vdc
 MAX. VALVE MAGNETIC FIELD DENSITY -
 ENERGIZED _____ nT @ 1 m (_____ GAMMA @ 6 in)
 DE-ENERGIZED _____ nT @ 1 m (_____ GAMMA @ 6 in)
 MATERIAL -
 CONSTRUCTION Stainless
 SEATS Single, AFE 102 Elastomer
 MASS24 kg (.55 lbfm)
 OTHER SIGNIFICANT CHARACTERISTICS

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.2 VALVE, HYDRAZINE THRUSTER

MANUFACTURER Moog, Inc.

PART NUMBER 50-415

PROGRAM..... Classified

CONTRACTING AGENCY.....

PRIME CONTRACTOR..... Rocket Research Corp.

STATUS

QUALIFIED..... Yes

FLOWN.....

LAUNCH VEHICLE.....

AVAILABILITY.....

COST/PROCUREMENT INFORMATION...

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.2 VALVE, HYDRAZINE THRUSTER

TYPE Series redundant solenoid, mono.
two seats, two coils
 USED WITH THRUSTER
 DESIGN FLOW MEDIA N₂H₄
 RATED FLOW AT PRESSURE DIFFERENTIAL0129 kg/sec @ 51 ^{+4.4}/_{-6.5} N/cm², _____ °C
 (.0285 lbm/sec @ 75 PSID, _____ °F)
 RESPONSE TIME -
 OPEN 9.6 ^{+1.2}/₋ ms @ 22 Vdc, 217 N/cm² INLET PRESSURE 121 °C
 (315 PSIA INLET PRESSURE 250 °F)
 CLOSE 5.2 ^{+0.7}/₋ ms @ 38 Vdc, 79.2 N/cm², 121 °C
 (115 PSIA 35 °F)
 LIFE 10⁶ CYCLES
 INTEGRAL FILTRATION _____ MICRONS ABSOLUTE
 PRESSURES -
 OPERATING INLET RANGE 217 N/cm² (315 PSIA)
 PROOF 665 N/cm² (965 PSIA)
 BURST 837.7 N/cm² (1215 PSIA)
 OPERATING TEMPERATURE RANGE +1.6 to 121 °C (+35 to 250 °F)
 LEAKAGE -
 INTERNAL 1.0 scc/hr OF GN₂ @ 10-217 N/cm²
 (15-315 PSIA)
 EXTERNAL 0 Bubbles cc/s OF GN₂ @ _____ N/cm²
 (_____ PSIA)
 SUPPLY VOLTAGE RANGE 24-33 Vdc
 POWER REQUIREMENTS _____ WATTS @ _____ Vdc, _____ °C (_____ °F)
 DIELECTRIC STRENGTH _____ mA MAXIMUM CURRENT LEAKAGE
 @ _____ VOLTS rms, _____ Hz
 INSULATION RESISTANCE _____ MΩ @ _____ Vdc
 MAX. VALVE MAGNETIC FIELD DENSITY -
 ENERGIZED _____ nT @ 1 m (_____ GAMMA @ 6 in)
 DE-ENERGIZED _____ nT @ 1 m (_____ GAMMA @ 6 in)
 MATERIAL -
 CONSTRUCTION Cres and Teflon Seals
 SEATS
 MASS 0.3 kg (0.8 lbm)
 OTHER SIGNIFICANT CHARACTERISTICS

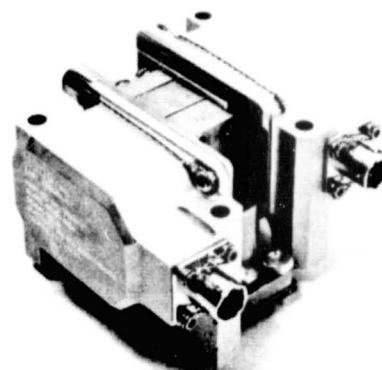
No sliding surfaces. All welded construction.

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.2 VALVE, HYDRAZINE THRUSTER

MANUFACTURER Moog, Inc. (35)

PART NUMBER 50-315AA



PROGRAM..... Titan Transtage

CONTRACTING AGENCY..... _____

PRIME CONTRACTOR..... Rocket Research Corp.

STATUS

QUALIFIED..... Yes

FLOWN..... Yes

LAUNCH VEHICLE..... _____

AVAILABILITY..... _____

COST/PROCUREMENT INFORMATION... _____

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.2 VALVE, HYDRAZINE THRUSTER

Series redundant torque motor operated;
Two torque motors

TYPE
USED WITH THRUSTER
DESIGN FLOW MEDIA N_2H_4
RATED FLOW AT PRESSURE DIFFERENTIAL ... 0.0530 kg/sec @ 41 N/cm², _____ °C
(0.117 lbm/sec @ 60 PSID, _____ °F)
RESPONSE TIME -
OPEN ms @ _____ Vdc, _____ N/cm² INLET PRESSURE _____ °C
(_____ PSIA INLET PRESSURE _____ °F)
CLOSE ms @ _____ Vdc, _____ N/cm², _____ °C
(_____ PSIA _____ °F)
LIFE 10^6 CYCLES
INTEGRAL FILTRATION MICRONS ABSOLUTE
PRESSURES -
OPERATING INLET RANGE 286 N/cm² (415 PSIA)
PROOF 699 N/cm² (1015 PSIA)
BURST N/cm² (_____ PSIA)
OPERATING TEMPERATURE RANGE °C ($+30$ to 200 °F)
LEAKAGE -
INTERNAL 5 scc/hr OF N_2 @ 206 N/cm²
(300 PSIA)
EXTERNAL 0 Bubbles scc/s OF GHe @ 275 N/cm²
(400 PSIA)
SUPPLY VOLTAGE RANGE $20-32$ Vdc
POWER REQUIREMENTS WATTS @ _____ Vdc, _____ °C (_____ °F)
DIELECTRIC STRENGTH mA MAXIMUM CURRENT LEAKAGE
@ _____ VOLTS rms, _____ Hz
INSULATION RESISTANCE MΩ @ _____ Vdc
MAX. VALVE MAGNETIC FIELD DENSITY -
ENERGIZED nT @ 1 m (_____ GAMMA @ 6 in)
DE-ENERGIZED nT @ 1 m (_____ GAMMA @ 6 in)
MATERIAL -
CONSTRUCTION
SEATS
MASS 1.0 kg (2.4 lbm)
OTHER SIGNIFICANT CHARACTERISTICS

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

MANUFACTURER Valcor Engineering (33)

PART NUMBER V67000-02

PROGRAM..... MOL

CONTRACTING AGENCY..... USAF

PRIME CONTRACTOR.....

STATUS

QUALIFIED..... Yes

FLOWN..... No

LAUNCH VEHICLE.....

AVAILABILITY..... Pre engineered hardware made to customer order

COST/PROCUREMENT INFORMATION... Quotation offered firm within 2 weeks of inquiry

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

PROPELLANT O₂ and H₂

VACUUM THRUST RANGE N (lbf)

INLET PRESSURE RANGE N/cm² (PSIA)

INLET TEMPERATURE RANGE °C (°F)

RATED FLOW AT PRESSURE DIFFERENTIAL .. .000416 scc/s @ 3 N/cm², 21 °C
(.000919 SCFH @ 5 PSID, 70 °F)

RESPONSE -

OPEN 25 ms @ 24 Vdc, 651 N/cm² INLET PRESSURE, 21 °C
(945 PSIA INLET PRESSURE, 70 °F)

CLOSE 18 ms @ Vdc, 656.3 N/cm², 21 °C
(951.9 PSIA, 70 °F)

MIN. COMMANDED PULSE WIDTH
(SIGNAL ON TO SIGNAL OFF) ms

LIFE 1x10⁵ CYCLES

PRESSURES -

PROOF 1044 N/cm² (1515 PSIA)

BURST 1389 N/cm² (2015 PSIA)

LEAKAGE -

INTERNAL 100 scc/HR OF He @ 661 N/cm² (960 PSIA)

EXTERNAL 1x10⁻⁵ scc/s OF He @ 661 N/cm² (960 PSIA)

SUPPLY VOLTAGE RANGE 22-31 Vdc

POWER REQUIREMENTS 45 WATTS @ 30 Vdc, 21 °C (70 °F)

DIELECTRIC STRENGTH mA MAXIMUM CURRENT LEAKAGE @ VOLTS rms, Hz

INSULATION RESISTANCE 100 MΩ @ 500 Vdc

MAXIMUM VALVE MAGNETIC FIELD DENSITY -

ENERGIZED nT @ 1 m (GAMMA @ 6 in)

DE-ENERGIZED nT @ 1 m (GAMMA @ 6 in)

NOZZLE REMOVABLE FROM VALVE
 INTEGRAL WITH VALVE

NOZZLE AREA RATIO

MATERIALS -

CONSTRUCTION 304 ST/ST/Teflon

SEATS

CONNECTIONS -

INLET 304

ELECTRICAL MIH-12-10P

MASS 1.6 kg (3.7 lbm)

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

MANUFACTURER Wright Components, Inc. (23)

PART NUMBER 15607

PROGRAM..... 1MP 1/H and LES 8/9

CONTRACTING AGENCY..... NASA/Goddard

PRIME CONTRACTOR..... _____

STATUS

QUALIFIED..... Yes

FLOWN..... Yes

LAUNCH VEHICLE..... _____

AVAILABILITY..... 18-24 weeks ARO

COST/PROCUREMENT INFORMATION... _____

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

PROPELLANT Air, N₂, He, CF₄ (Freon 14)

VACUUM THRUST RANGE N (lbf)

INLET PRESSURE RANGE N/cm² (PSIA)

INLET TEMPERATURE RANGE °C (°F)

RATED FLOW AT PRESSURE DIFFERENTIAL .. 9 x 10⁻¹ scc/s @ 2 N/cm², 24 °C
(2 x 10⁻³ SCFM @ 3 PSID, 76 °F)

RESPONSE -

OPEN 15 ms @ Vdc, N/cm² INLET PRESSURE, °C
(PSIA INLET PRESSURE, °F)

CLOSE 15 ms @ Vdc, N/cm², °C
(PSIA, °F)

MIN. COMMANDED PULSE WIDTH
(SIGNAL ON TO SIGNAL OFF) ms

LIFE 2000 ~~cycles~~ Hours

PRESSURES -

PROOF 72.3 N/cm² (105 PSIA)

BURST 175 N/cm² (255 PSIA)

LEAKAGE -

INTERNAL 3 x 10⁻³ scc/HR OF He @ 51 N/cm² (75 PSIA)

EXTERNAL 1 x 10⁻⁶ scc/s OF He @ 51 N/cm² (75 PSIA)

SUPPLY VOLTAGE RANGE 28 Vdc

POWER REQUIREMENTS 2 WATTS @ 26 Vdc, 24 °C (76 °F)

DIELECTRIC STRENGTH 5 mA MAXIMUM CURRENT LEAKAGE @ 500 VOLTS rms, 60 Hz

INSULATION RESISTANCE 5 MΩ @ 500 Vdc

MAXIMUM VALVE MAGNETIC FIELD DENSITY -

ENERGIZED nT @ 1 m (GAMMA @ 6 in)

DE-ENERGIZED nT @ 1 m (GAMMA @ 6 in)

NOZZLE REMOVABLE FROM VALVE
 INTEGRAL WITH VALVE

NOZZLE AREA RATIO

MATERIALS -

CONSTRUCTION Stainless steel

SEATS EPR-515-8

CONNECTIONS -

INLET

ELECTRICAL

MASS 0.11 kg (0.25 lbm)

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

MANUFACTURER Allen Design, Inc. (27)

PART NUMBER 13880

PROGRAM..... Aerobee

CONTRACTING AGENCY.....

PRIME CONTRACTOR..... Aerojet

STATUS

QUALIFIED.....

FLOWN..... Yes

LAUNCH VEHICLE.....

AVAILABILITY.....

COST/PROCUREMENT INFORMATION... One - \$565

100 - \$285

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

PROPELLANT	<u>GHe</u>	
VACUUM THRUST RANGE	<u> </u> N	(<u> </u> lbf)
INLET PRESSURE RANGE	<u> </u> N/cm ²	(<u> </u> PSIA)
INLET TEMPERATURE RANGE	<u>-42 to +71.1</u> °C	(<u>-45 to +160</u> °F)
RATED FLOW AT PRESSURE DIFFERENTIAL ..	<u>39.1</u> scc/s @ <u> </u> N/cm ² , <u> </u> °C	
	(<u>.033</u> SCFM @ <u> </u> PSID, <u> </u> °F)	
RESPONSE -		
OPEN	<u>10</u> ms @ <u>24</u> Vdc, <u>117</u> N/cm ² INLET PRESSURE, <u>20</u> °C	(<u>170</u> PSIA INLET PRESSURE, <u>68</u> °F)
CLOSE	<u>10</u> ms @ <u>32</u> Vdc, <u>44</u> N/cm ² , <u>20</u> °C	(<u>65</u> PSIA, <u>68</u> °F)
MIN. COMMANDED PULSE WIDTH (SIGNAL ON TO SIGNAL OFF)	<u> </u> ms	
LIFE	<u>100,000</u> CYCLES	
PRESSURES -		
PROOF	<u> </u> N/cm ²	(<u> </u> PSIA)
BURST	<u> </u> N/cm ²	(<u> </u> PSIA)
LEAKAGE -		
INTERNAL	<u>6</u> scc/HR OF <u>He</u> @ <u> </u> N/cm ² (<u> </u> PSIA)	
EXTERNAL	<u>None</u> scc/s OF <u> </u> @ <u> </u> N/cm ² (<u> </u> PSIA)	
SUPPLY VOLTAGE RANGE	<u>22-32</u> Vdc	
POWER REQUIREMENTS	<u> </u> WATTS @ <u> </u> Vdc, <u> </u> °C (<u> </u> °F)	
DIELECTRIC STRENGTH	<u> </u> mA MAXIMUM CURRENT LEAKAGE @ <u> </u> VOLTS rms, <u> </u> Hz	
INSULATION RESISTANCE	<u> </u> MΩ @ <u> </u> Vdc	
MAXIMUM VALVE MAGNETIC FIELD DENSITY -		
ENERGIZED	<u> </u> nT @ 1 m (GAMMA @ 6 in)	
DE-ENERGIZED	<u> </u> nT @ 1 m (GAMMA @ 6 in)	
NOZZLE	<u> </u> REMOVABLE FROM VALVE	
	<u> </u> INTEGRAL WITH VALVE	
NOZZLE AREA RATIO	<u> </u>	
MATERIALS -		
CONSTRUCTION	<u> </u>	
SEATS	<u> </u>	
CONNECTIONS -		
INLET	<u> </u>	
ELECTRICAL	<u> </u>	
MASS	<u>0.13</u> kg	(<u>0.30</u> lbm)
OTHER SIGNIFICANT CHARACTERISTICS	For cold gases and hydrazine.	

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

MANUFACTURER SieBelAir Corp. (51)

PART NUMBER 2900-0 thru -7

(Dash no. designates flow
rating)

PROGRAM..... Thrust Vector Control Valves for HI STAR,
SCOOP, AEROBEE, MK III & SUPER CHIEF

CONTRACTING AGENCY..... _____

PRIME CONTRACTOR..... Aerojet Liquid Rocket Co.

STATUS

QUALIFIED..... Yes

FLOWN..... Yes

LAUNCH VEHICLE..... Noted above

AVAILABILITY..... 4 to 12 weeks ARO depending on quantity

COST/PROCUREMENT INFORMATION... _____

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

PROPELLANT GN₂, GHe, Air

VACUUM THRUST RANGE N (lbf)

INLET PRESSURE RANGE 0-424 N/cm² (0-615 PSIA)

INLET TEMPERATURE RANGE -53 to 73.8 °C (-65 to +165 °F)

RATED FLOW AT PRESSURE DIFFERENTIAL .. 60.4-332 scc/s @ 196 N/cm², °C

(.128-.704 SCFM @ 285 PSID, °F)

RESPONSE -

OPEN 15 ms @ Vdc, 424 N/cm² INLET PRESSURE, 21 °C

(615 PSIA INLET PRESSURE, 70 °F)

CLOSE 5 ms @ Vdc, 424 N/cm², 21 °C

(615 PSIA, 70 °F)

MIN. COMMANDED PULSE WIDTH
(SIGNAL ON TO SIGNAL OFF) 5 ms

LIFE 5 x 10⁴ CYCLES

PRESSURES -

PROOF 527 N/cm² (765 PSIA)

BURST 630 N/cm² (915 PSIA)

LEAKAGE -

INTERNAL 3.0 scc/HR OF GN₂ @ 0-424 N/cm² (0-615 PSIA)

EXTERNAL 1 x 10⁻⁵ scc/s OF GN₂ @ 0-424 N/cm² (0-615 PSIA)

SUPPLY VOLTAGE RANGE 18-32 Vdc

POWER REQUIREMENTS 32 WATTS @ 24 Vdc, 21 °C (70 °F)

DIELECTRIC STRENGTH mA MAXIMUM CURRENT LEAKAGE @ 1250 VOLTS rms, 60 Hz

INSULATION RESISTANCE 500 MΩ @ 500 Vdc

MAXIMUM VALVE MAGNETIC FIELD DENSITY -

ENERGIZED nT @ 1 m (GAMMA @ 6 in)

DE-ENERGIZED nT @ 1 m (GAMMA @ 6 in)

NOZZLE Yes REMOVABLE FROM VALVE

No INTEGRAL WITH VALVE

NOZZLE AREA RATIO As required

MATERIALS -

CONSTRUCTION Electroless Ni-PL-STL or Cres

SEATS Cres poppet and seat plus elastomeric seal

CONNECTIONS -

INLET Threaded modular

ELECTRICAL Bendix Pygmy P/NPT02H-8-2P

MASS 0.31 kg (0.70 lbm)

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

MANUFACTURER Allen Design, Inc. (27)

PART NUMBER 13515

PROGRAM..... Aerobee

CONTRACTING AGENCY.....

PRIME CONTRACTOR..... Aerojet Mfg.

STATUS

QUALIFIED..... Yes

FLOWN..... Yes

LAUNCH VEHICLE.....

AVAILABILITY.....

COST/PROCUREMENT INFORMATION... One - \$520

100 - \$265

4.3.3 VALVE, COLD GAS JET

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ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

MANUFACTURER Allen Design, Inc. (27)

PART NUMBER 13422-03

PROGRAM..... Delta

CONTRACTING AGENCY.....

PRIME CONTRACTOR..... Aerojet Mfg.

STATUS

QUALIFIED..... Yes

FLOWN..... Yes

LAUNCH VEHICLE.....

AVAILABILITY.....

COST/PROCUREMENT INFORMATION... One - \$650

100 - \$310

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

PROPELLANT GN₂
 VACUUM THRUST RANGE 17 N (4.0 lbf)
 INLET PRESSURE RANGE 45 to +71.1 N/cm² (PSIA)
 INLET TEMPERATURE RANGE °C (-50 to +160 °F)
 RATED FLOW AT PRESSURE DIFFERENTIAL .. 420 scc/s @ 196 N/cm², °C
 (0.89 SCFM @ 285 PSID, °F)
 RESPONSE -
 OPEN 25 ms @ 23 Vdc, 206 N/cm² INLET PRESSURE, 20 °C
 (300 PSIA INLET PRESSURE, 68 °F)
 CLOSE 25 ms @ 32 Vdc, 206 N/cm², 20 °C
 (300 PSIA, 68 °F)
 MIN. COMMANDED PULSE WIDTH
 (SIGNAL ON TO SIGNAL OFF) ms
 LIFE CYCLES
 PRESSURES -
 PROOF 630 N/cm² (915 PSIA)
 BURST 1044 N/cm² (1515 PSIA)
 LEAKAGE -
 INTERNAL 110 scc/HR OF @ N/cm² (PSIA)
 EXTERNAL None scc/s OF @ N/cm² (PSIA)
 SUPPLY VOLTAGE RANGE 23-32 Vdc
 POWER REQUIREMENTS 1.6 WATTS @ Vdc, °C (°F)
 DIELECTRIC STRENGTH mA MAXIMUM CURRENT LEAKAGE @ VOLTS rms, Hz
 INSULATION RESISTANCE MΩ @ Vdc
 MAXIMUM VALVE MAGNETIC FIELD DENSITY -
 ENERGIZED nT @ 1 m (GAMMA @ 6 in)
 DE-ENERGIZED nT @ 1 m (GAMMA @ 6 in)
 NOZZLE yes REMOVABLE FROM VALVE
 INTEGRAL WITH VALVE
 NOZZLE AREA RATIO
 MATERIALS -
 CONSTRUCTION
 SEATS Stainless steel
 CONNECTIONS -
 INLET
 ELECTRICAL
 MASS 0.18 kg (0.41 lbm)
 OTHER SIGNIFICANT CHARACTERISTICS For use with any non-corrosive gas or liquid.

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

MANUFACTURER Sterer Engineering (43)

PART NUMBER 34880

PROGRAM..... Project 169

CONTRACTING AGENCY..... USAF

PRIME CONTRACTOR..... TRW Systems

STATUS

QUALIFIED..... Yes

FLOWN.....

LAUNCH VEHICLE.....

AVAILABILITY.....

COST/PROCUREMENT INFORMATION...

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

PROPELLANT GN₂
 VACUUM THRUST RANGE 4 N (0.1 lbf)
 INLET PRESSURE RANGE 34 N/cm² (50 PSIA)
 INLET TEMPERATURE RANGE °C (°F)
 RATED FLOW AT PRESSURE DIFFERENTIAL .. 566 scc/s @ 34 N/cm², 15 °C
 (1.2 SCFM @ 50 PSID, 60 °F)
 RESPONSE -
 OPEN 20 ms @ Vdc, N/cm² INLET PRESSURE, °C
 (PSIA INLET PRESSURE, °F)
 CLOSE 15 ms @ Vdc, N/cm², °C
 (PSIA, °F)
 MIN. COMMANDED PULSE WIDTH
 (SIGNAL ON TO SIGNAL OFF) ms
 LIFE CYCLES
 PRESSURES -
 PROOF 89.6 N/cm² (130 PSIA)
 BURST 179 N/cm² (260 PSIA)
 LEAKAGE -
 INTERNAL 0.1 scc/HR OF @ N/cm² (PSIA)
 EXTERNAL scc/s OF @ N/cm² (PSIA)
 SUPPLY VOLTAGE RANGE 24-32 Vdc
 POWER REQUIREMENTS WATTS @ Vdc, °C (°F)
 DIELECTRIC STRENGTH mA MAXIMUM CURRENT LEAKAGE @ VOLTS rms, Hz
 INSULATION RESISTANCE MΩ @ Vdc
 MAXIMUM VALVE MAGNETIC FIELD DENSITY -
 ENERGIZED nT @ 1 m (GAMMA @ 6 in)
 DE-ENERGIZED nT @ 1 m (GAMMA @ 6 in)
 NOZZLE Yes REMOVABLE FROM VALVE
 INTEGRAL WITH VALVE
 NOZZLE AREA RATIO
 MATERIALS -
 CONSTRUCTION
 SEATS
 CONNECTIONS -
 INLET
 ELECTRICAL
 MASS kg (lbm)

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

MANUFACTURER Sterer Engineering (43)

PART NUMBER 29830

PROGRAM..... Project 'PRIME'

CONTRACTING AGENCY.....

PRIME CONTRACTOR..... Martin Marietta

STATUS

QUALIFIED..... Yes

FLOWN.....

LAUNCH VEHICLE.....

AVAILABILITY.....

COST/PROCUREMENT INFORMATION...

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

PROPELLANT GN₂

VACUUM THRUST RANGE88 N (.20 lbf)

INLET PRESSURE RANGE 34 N/cm² (50 PSIA)

INLET TEMPERATURE RANGE _____ °C (_____ °F)

RATED FLOW AT PRESSURE DIFFERENTIAL .. 1132 scc/s @ 34 N/cm², 15 °C
(2.4 SCFM @ 50 PSID, 60 °F)

RESPONSE -

OPEN 20 ms @ 24.5 Vdc, _____ N/cm² INLET PRESSURE, _____ °C
(_____ PSIA INLET PRESSURE, _____ °F)

CLOSE 15 ms @ _____ Vdc, _____ N/cm², _____ °C
(_____ PSIA, _____ °F)

MIN. COMMANDED PULSE WIDTH
(SIGNAL ON TO SIGNAL OFF) _____ ms

LIFE _____ CYCLES

PRESSURES -

PROOF 355 N/cm² (515 PSIA)

BURST 699 N/cm² (1015 PSIA)

LEAKAGE -

INTERNAL 3.0 scc/HR OF _____ @ _____ N/cm² (_____ PSIA)

EXTERNAL _____ scc/s OF _____ @ _____ N/cm² (_____ PSIA)

SUPPLY VOLTAGE RANGE _____ Vdc

POWER REQUIREMENTS _____ WATTS @ _____ Vdc, _____ °C (_____ °F)

DIELECTRIC STRENGTH _____ mA MAXIMUM CURRENT LEAKAGE @ _____ VOLTS rms, _____ Hz

INSULATION RESISTANCE _____ MΩ @ _____ Vdc

MAXIMUM VALVE MAGNETIC FIELD DENSITY -

ENERGIZED _____ nT @ 1 m (GAMMA @ 6 in)

DE-ENERGIZED _____ nT @ 1 m (GAMMA @ 6 in)

NOZZLE Yes REMOVABLE FROM VALVE
_____ INTEGRAL WITH VALVE

NOZZLE AREA RATIO _____

MATERIALS -

CONSTRUCTION Stainless steel

SEATS _____

CONNECTIONS -

INLET _____

ELECTRICAL _____

MASS _____ kg (_____ lbf)

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

MANUFACTURER Valcor Engineering (33)

PART NUMBER V27200-288

PROGRAM..... Classified Re-Entry

CONTRACTING AGENCY..... USAF

PRIME CONTRACTOR..... General Electric

STATUS

QUALIFIED..... Yes, by G.E.

FLOWN..... Yes

LAUNCH VEHICLE.....

AVAILABILITY.....

COST/PROCUREMENT INFORMATION...

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

PROPELLANT GN₂, GHe

VACUUM THRUST RANGE N (lbf)

INLET PRESSURE RANGE N/cm² (PSIA)

INLET TEMPERATURE RANGE -37 to 71.1 °C (-35 to +160 °F)

RATED FLOW AT PRESSURE DIFFERENTIAL .. 236 scc/s @ 6.8 N/cm², 21 °C
 (5 SCFM @ 10 PSID, 70 °F)

RESPONSE -

OPEN 100 ms @ 24 Vdc, 3309 N/cm² INLET PRESSURE, 21 °C
 (4800 PSIA INLET PRESSURE, 70 °F)

CLOSE 100 ms @ Vdc, 3309 N/cm², 21 °C
 (4800 PSIA, °F)

MIN. COMMANDED PULSE WIDTH
 (SIGNAL ON TO SIGNAL OFF) ms

LIFE 1 x 10⁵ CYCLES

PRESSURES -

PROOF 4974 N/cm² (7215 PSIA)

BURST N/cm² (PSIA)

LEAKAGE -

INTERNAL 13 scc/ 5 min OF GHe @ 3309 N/cm² (4800 PSIA)

EXTERNAL scc/s OF @ N/cm² (PSIA)

SUPPLY VOLTAGE RANGE 22-32 Vdc

POWER REQUIREMENTS 60 WATTS @ 30 Vdc, 21 °C (70 °F)

DIELECTRIC STRENGTH mA MAXIMUM CURRENT LEAKAGE @ 500 VOLTS rms, 60 Hz

INSULATION RESISTANCE 50 MΩ @ 500 Vdc

MAXIMUM VALVE MAGNETIC FIELD DENSITY -

ENERGIZED nT @ 1 m (GAMMA @ 6 in)

DE-ENERGIZED nT @ 1 m (GAMMA @ 6 in)

NOZZLE REMOVABLE FROM VALVE
 INTEGRAL WITH VALVE

NOZZLE AREA RATIO

MATERIALS -

CONSTRUCTION 303 ST/ST - Nylon

SEATS

CONNECTIONS -

INLET MS 33514-4

ELECTRICAL PT1H-8-3P

MASS 0.54 kg (1.2 lbm)

4.3.3-18

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

MANUFACTURER Allen Design, Inc. (27)

PART NUMBER 13705

PROGRAM..... Aerobee

CONTRACTING AGENCY.....

PRIME CONTRACTOR..... Aerojet Mfg.

STATUS

QUALIFIED..... Yes

FLOWN..... Yes

LAUNCH VEHICLE.....

AVAILABILITY.....

COST/PROCUREMENT INFORMATION... One - \$950

100 - \$470

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

PROPELLANT Gaseous Helium
 VACUUM THRUST RANGE _____ N (_____ lbf)
 INLET PRESSURE RANGE 44-355 N/cm² (65-515 PSIA)
 INLET TEMPERATURE RANGE _____ °C (_____ °F)
 RATED FLOW AT PRESSURE DIFFERENTIAL .. 2.8 x 10³ scc/s @ 296 N/cm², 15 °C
 (6.0 SCFM @ 430 PSID, 60 °F)
 RESPONSE -
 OPEN 25 ms @ 25 Vdc, 306 N/cm² INLET PRESSURE, 20 °C
 (445 PSIA INLET PRESSURE, 68 °F)
 CLOSE 20 ms @ 25 Vdc, 144 N/cm², 20 °C
 (210 PSIA, 68 °F)
 MIN. COMMANDED PULSE WIDTH
 (SIGNAL ON TO SIGNAL OFF) _____ ms
 LIFE 100,000 CYCLES
 PRESSURES -
 PROOF 699 N/cm² (1015 PSIA)
 BURST 1044 N/cm² (1515 PSIA)
 LEAKAGE -
 INTERNAL 6 scc/HR OF _____ @ _____ N/cm² (_____ PSIA)
 EXTERNAL None scc/s OF _____ @ _____ N/cm² (_____ PSIA)
 SUPPLY VOLTAGE RANGE 25-28 Vdc
 POWER REQUIREMENTS _____ WATTS @ _____ Vdc, _____ °C (_____ °F)
 DIELECTRIC STRENGTH _____ mA MAXIMUM CURRENT LEAKAGE @ _____ VOLTS rms, _____ Hz
 INSULATION RESISTANCE _____ MΩ @ _____ Vdc
 MAXIMUM VALVE MAGNETIC FIELD DENSITY -
 ENERGIZED _____ nT @ 1 m (GAMMA @ 6 in)
 DE-ENERGIZED _____ nT @ 1 m (GAMMA @ 6 in)
 NOZZLE _____ REMOVABLE FROM VALVE
 _____ INTEGRAL WITH VALVE
 NOZZLE AREA RATIO _____
 MATERIALS -
 CONSTRUCTION _____
 SEATS _____
 CONNECTIONS -
 INLET _____
 ELECTRICAL _____
 MASS 0.453 kg (1.00 lbm) (Est.)
 OTHER SIGNIFICANT CHARACTERISTICS Valve conforms with Space General Spec AGC-71002/3,
 Amendment 1.

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

MANUFACTURER Allen Design, Inc. (27)

PART NUMBER 13854

PROGRAM..... Aerobee

CONTRACTING AGENCY..... NASA

PRIME CONTRACTOR.....

STATUS

QUALIFIED.....

FLOWN..... Yes

LAUNCH VEHICLE.....

AVAILABILITY.....

COST/PROCUREMENT INFORMATION...

One - \$490

100 - \$245

4.3.3 VALVE, COLD GAS JET

PROPELLANT	GHe	
VACUUM THRUST RANGE	_____ N	(_____ lbf)
INLET PRESSURE RANGE	<u>34-206</u> N/cm ²	(<u>50-300</u> PSIA)
INLET TEMPERATURE RANGE	<u>-17 to 71</u> °C	(<u>0 to +160</u> °F)
RATED FLOW AT PRESSURE DIFFERENTIAL ..	<u>3.3 x 10³</u> scc/s @ <u>196</u> N/cm ² , _____ °C	(<u>7.1</u> SCFM @ <u>285</u> PSID, _____ °F)
RESPONSE -		
OPEN	<u>25</u> ms @ <u>26</u> Vdc, <u>217</u> N/cm ² INLET PRESSURE, <u>20</u> °C	(<u>315</u> PSIA INLET PRESSURE, <u>68</u> °F)
CLOSE	<u>25</u> ms @ <u>26</u> Vdc, <u>217</u> N/cm ² , <u>20</u> °C	(<u>315</u> PSIA, <u>68</u> °F)
MIN. COMMANDED PULSE WIDTH (SIGNAL ON TO SIGNAL OFF)	_____ ms	
LIFE	<u>100,000</u> CYCLES	
PRESSURES -		
PROOF	<u>699</u> N/cm ²	(<u>1015</u> PSIA)
BURST	<u>1044</u> N/cm ²	(<u>1515</u> PSIA)
LEAKAGE -		
INTERNAL	<u>12</u> scc/HR OF _____ @ _____ N/cm ² (_____ PSIA)	
EXTERNAL	<u>.001</u> scc/s OF _____ @ _____ N/cm ² (_____ PSIA)	
SUPPLY VOLTAGE RANGE	<u>26-32</u> Vdc	
POWER REQUIREMENTS	<u>1.5</u> ^{Amps} WATTS @ <u>28</u> Vdc, <u>15</u> °C (<u>60</u> °F)	
DIELECTRIC STRENGTH	_____ mA MAXIMUM CURRENT LEAKAGE @ _____ VOLTS rms, _____ Hz	
INSULATION RESISTANCE	_____ MΩ @ _____ Vdc	
MAXIMUM VALVE MAGNETIC FIELD DENSITY -		
ENERGIZED	_____ nT @ 1 m (GAMMA @ 6 in)	
DE-ENERGIZED	_____ nT @ 1 m (GAMMA @ 6 in)	
NOZZLE	_____ REMOVABLE FROM VALVE	
	_____ INTEGRAL WITH VALVE	
NOZZLE AREA RATIO	_____	
MATERIALS -		
CONSTRUCTION	_____	
SEATS	_____	
CONNECTIONS -		
INLET	_____	
ELECTRICAL	_____	
MASS	<u>0.36</u> kg	(<u>0.80</u> lbm)
OTHER SIGNIFICANT CHARACTERISTICS	Valve may be used for cold gas or hydrazine.	

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

MANUFACTURER Sterer Engineering (16)

PART NUMBER 33130

PROGRAM..... ERTS

CONTRACTING AGENCY..... NASA

PRIME CONTRACTOR.....

STATUS

QUALIFIED..... yes

FLOWN..... yes

LAUNCH VEHICLE..... Delta DSV-3N-11

AVAILABILITY.....

COST/PROCUREMENT INFORMATION...

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

PROPELLANT CF₄

VACUUM THRUST RANGE N (lbf)

INLET PRESSURE RANGE 46-55 N/cm² (67-80 PSIA)

INLET TEMPERATURE RANGE °C (°F)

RATED FLOW AT PRESSURE DIFFERENTIAL .. 3.9x10⁻³ scc/s @ N/cm², °C
(8.3 SCFM @ PSID, °F)

RESPONSE -

OPEN 30 ms @ Vdc, N/cm² INLET PRESSURE, °C
(PSIA INLET PRESSURE, °F)

CLOSE 9 ms @ Vdc, N/cm², °C
(PSIA, °F)

MIN. COMMANDED PULSE WIDTH
(SIGNAL ON TO SIGNAL OFF) ms

LIFE 3x10⁵ CYCLES

PRESSURES -

PROOF 79.2 N/cm² (115 PSIA)

BURST 189 N/cm² (275 PSIA)

LEAKAGE -

INTERNAL scc/HR OF @ N/cm² (PSIA)

EXTERNAL 2x10⁻⁵ scc/s OF @ N/cm² (PSIA)

SUPPLY VOLTAGE RANGE 24.5 Vdc

POWER REQUIREMENTS WATTS @ Vdc, °C (°F)

DIELECTRIC STRENGTH 750 mA MAXIMUM CURRENT LEAKAGE @ VOLTS rms, Hz

INSULATION RESISTANCE MΩ @ Vdc

MAXIMUM VALVE MAGNETIC FIELD DENSITY -

ENERGIZED nT @ 1 m (GAMMA @ 6 in)

DE-ENERGIZED nT @ 1 m (GAMMA @ 6 in)

NOZZLE REMOVABLE FROM VALVE
 INTEGRAL WITH VALVE

NOZZLE AREA RATIO

MATERIALS -

CONSTRUCTION

SEATS

CONNECTIONS -

INLET

ELECTRICAL

MASS 0.34 kg (0.75 lbm)

4.3.3-24

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

MANUFACTURER Allen Design, Inc. (27)

PART NUMBER 13903

PROGRAM.....

CONTRACTING AGENCY.....

PRIME CONTRACTOR..... Philco-Ford

STATUS

QUALIFIED.....

FLOWN..... Yes

LAUNCH VEHICLE.....

AVAILABILITY.....

COST/PROCUREMENT INFORMATION... One - \$875

100 - \$445

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

PROPELLANT	<u>GN₂</u>	
VACUUM THRUST RANGE	_____ N	(_____ lbf)
INLET PRESSURE RANGE	_____ N/cm ²	(_____ PSIA)
INLET TEMPERATURE RANGE	<u>-17 to +71.1</u> °C	(<u>0 to +160</u> °F)
RATED FLOW AT PRESSURE DIFFERENTIAL ..	<u>7.69 x 10³</u> scc/s @ <u>79</u> N/cm ² , _____ °C (<u>15.3</u> SCFM @ <u>115</u> PSID, _____ °F)	
RESPONSE -		
OPEN	<u>25</u> ms @ <u>24</u> Vdc, <u>492</u> N/cm ² INLET PRESSURE, _____ °C (<u>715</u> PSIA INLET PRESSURE, _____ °F)	
CLOSE	<u>25</u> ms @ <u>24</u> Vdc, <u>492</u> N/cm ² , _____ °C (<u>715</u> PSIA, _____ °F)	
MIN. COMMANDED PULSE WIDTH (SIGNAL ON TO SIGNAL OFF)	_____ ms	
LIFE	<u>50,000</u> CYCLES	
PRESSURES -		
PROOF	_____ N/cm ²	(_____ PSIA)
BURST	_____ N/cm ²	(_____ PSIA)
LEAKAGE -		
INTERNAL	<u>1</u> Bubble scc/hr OF <u>GN₂</u> @ <u>5</u> min N/cm ² (_____ PSIA)	
EXTERNAL	<u>1x10⁻⁴</u> scc/s OF <u>GN₂</u> @ _____ N/cm ² (_____ PSIA)	
SUPPLY VOLTAGE RANGE	<u>22-30</u> Vdc	
POWER REQUIREMENTS	_____ WATTS @ _____ Vdc, _____ °C (_____ °F)	
DIELECTRIC STRENGTH	_____ mA MAXIMUM CURRENT LEAKAGE @ _____ VOLTS rms, _____ Hz	
INSULATION RESISTANCE	_____ MΩ @ _____ Vdc	
MAXIMUM VALVE MAGNETIC FIELD DENSITY -		
ENERGIZED	_____ nT @ 1 m (GAMMA @ 6 in)	
DE-ENERGIZED	_____ nT @ 1 m (GAMMA @ 6 in)	
NOZZLE	_____ REMOVABLE FROM VALVE _____ INTEGRAL WITH VALVE	
NOZZLE AREA RATIO	_____	
MATERIALS -		
CONSTRUCTION	_____	
SEATS	_____	
CONNECTIONS -		
INLET	_____	
ELECTRICAL	_____	
MASS	_____ kg	(_____ lbm)
OTHER SIGNIFICANT CHARACTERISTICS	Has internal switch to indicate valve operation.	

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

MANUFACTURER Sterer Engineering (43)

PART NUMBER 24050

PROGRAM..... Project 'FIRE'

CONTRACTING AGENCY.....

PRIME CONTRACTOR..... LTV

STATUS

QUALIFIED..... Yes

FLOWN.....

LAUNCH VEHICLE.....

AVAILABILITY.....

COST/PROCUREMENT INFORMATION...

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

PROPELLANT GN₂
 VACUUM THRUST RANGE 11 N (2.5 lbf)
 INLET PRESSURE RANGE 206 N/cm² (300 PSIA)
 INLET TEMPERATURE RANGE -17 to 85.5 °C (0 to 186 °F)
 RATED FLOW AT PRESSURE DIFFERENTIAL .. 1.4x10⁴ scc/s @ 206 N/cm², 15 °C
 (30 SCFM @ 300 PSID, 60 °F)
 RESPONSE -
 OPEN 15 ms @ _____ Vdc, _____ N/cm² INLET PRESSURE, _____ °C
 (_____ PSIA INLET PRESSURE, _____ °F)
 CLOSE _____ ms @ _____ Vdc, _____ N/cm², _____ °C
 (_____ PSIA, _____ °F)
 MIN. COMMANDED PULSE WIDTH
 (SIGNAL ON TO SIGNAL OFF) _____ ms
 LIFE _____ CYCLES
 PRESSURES -
 PROOF 206 N/cm² (600 PSIA)
 BURST 689.4 N/cm² (1000 PSIA)
 LEAKAGE -
 INTERNAL 0.25 scc/HR OF _____ @ _____ N/cm² (_____ PSIA)
 EXTERNAL 6.9x10⁻⁵ scc/s OF _____ @ _____ N/cm² (_____ PSIA)
 SUPPLY VOLTAGE RANGE 24-32 Vdc
 POWER REQUIREMENTS _____ WATTS @ _____ Vdc, _____ °C (_____ °F)
 DIELECTRIC STRENGTH _____ mA MAXIMUM CURRENT LEAKAGE @ _____ VOLTS rms, _____ Hz
 INSULATION RESISTANCE _____ MΩ @ _____ Vdc
 MAXIMUM VALVE MAGNETIC FIELD DENSITY -
 ENERGIZED _____ nT @ 1 m (GAMMA @ 6 in)
 DE-ENERGIZED _____ nT @ 1 m (GAMMA @ 6 in)
 NOZZLE Yes REMOVABLE FROM VALVE
 _____ INTEGRAL WITH VALVE
 NOZZLE AREA RATIO _____
 MATERIALS -
 CONSTRUCTION _____
 SEATS _____
 CONNECTIONS -
 INLET _____
 ELECTRICAL _____
 MASS2 kg (.5 lbm)

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

MANUFACTURER SieBelAir Corp. (51)

PART NUMBER 2950-0 & A/R

PROGRAM..... Thrust Vector Control Valve for
SUPER CHIEF & NRL Sounding Rockets

CONTRACTING AGENCY.....

PRIME CONTRACTOR..... Aerojet Liquid Rocket Co.

STATUS

QUALIFIED..... Yes

FLOWN..... Yes

LAUNCH VEHICLE..... Noted above

AVAILABILITY..... 4 to 12 weeks ARO depending on quantity

COST/PROCUREMENT INFORMATION...

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

PROPELLANT GN₂, GHe, Air

VACUUM THRUST RANGE N (lbf)

INLET PRESSURE RANGE 0-424 N/cm² (0-615 PSIA)

INLET TEMPERATURE RANGE -53 to 73.8 °C (-65 to +165 °F)

RATED FLOW AT PRESSURE DIFFERENTIAL .. 1.8x10⁻⁴ - 1.8x10⁻⁵ scc/s @ 196 N/cm², °C GN₂

(38-384 SCFM @ 285 PSID, °F)

RESPONSE -

OPEN 20 ms @ Vdc, 424 N/cm² INLET PRESSURE, 21 °C

(615 PSIA INLET PRESSURE, 70 °F)

CLOSE 10 ms @ Vdc, 424 N/cm², 21 °C

(615 PSIA, 70 °F)

MIN. COMMANDED PULSE WIDTH
(SIGNAL ON TO SIGNAL OFF) 10 ms

LIFE 5 x 10⁴ CYCLES

PRESSURES -

PROOF 527 N/cm² (765 PSIA)

BURST 630 N/cm² (915 PSIA)

LEAKAGE -

INTERNAL 3.0 scc/HR OF GN₂ @ 0-424 N/cm² (0-615 PSIA)

EXTERNAL 1 x 10⁻⁵ scc/s OF GN₂ @ 0-424 N/cm² (0-615 PSIA)

SUPPLY VOLTAGE RANGE 18-32 Vdc

POWER REQUIREMENTS 32 WATTS @ 24 Vdc, 21 °C (70 °F)

DIELECTRIC STRENGTH mA MAXIMUM CURRENT LEAKAGE @ 1250 VOLTS rms, 60 Hz

INSULATION RESISTANCE 500 MΩ @ 500 Vdc

MAXIMUM VALVE MAGNETIC FIELD DENSITY -

ENERGIZED nT @ 1 m (GAMMA @ 6 in)

DE-ENERGIZED nT @ 1 m (GAMMA @ 6 in)

NOZZLE Yes REMOVABLE FROM VALVE

No INTEGRAL WITH VALVE

NOZZLE AREA RATIO As required

MATERIALS -

CONSTRUCTION Electroless Ni-PL-STL, Cres, & Al. Al.

SEATS Cres poppet & seat plus elastomeric seal

CONNECTIONS -

INLET Bolt flanged modular

ELECTRICAL Bendix Pygmy PINPT02H-8-2P

MASS45 kg (1.0 lbm)

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

MANUFACTURER Consolidated Controls Corp.
(20)

PART NUMBER 72520

PROGRAM..... Delta Thor Second Stage

CONTRACTING AGENCY..... NASA

PRIME CONTRACTOR..... McDonnell Douglas Astronautics Co.

STATUS

QUALIFIED..... Yes

FLOWN..... Yes

LAUNCH VEHICLE..... Delta Thor

AVAILABILITY..... 180 days

COST/PROCUREMENT INFORMATION... \$900 (per unit at 1-5 units)

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET
Type Solenoid, - 2 way
GN₂

PROPELLANT
VACUUM THRUST RANGE N (lbf)
INLET PRESSURE RANGE N/cm² (PSIA)
INLET TEMPERATURE RANGE -123 to 65.5 °C (190 to 150 °F)
RATED FLOW AT PRESSURE DIFFERENTIAL .. 18 x 10⁴ scc/s @ 175 N/cm², 21 °C
(39 SCFM @ 255 PSID, 70 °F)

RESPONSE -
OPEN 0.25 ms @ 24 Vdc, N/cm² INLET PRESSURE, 21 °C
(315 PSIA INLET PRESSURE, 70 °F)
CLOSE 0.25 ms @ 24 Vdc, N/cm², 21 °C
(315 PSIA, 70 °F)

MIN. COMMANDED PULSE WIDTH
(SIGNAL ON TO SIGNAL OFF) ms
LIFE 1 x 10⁶ CYCLES

PRESSURES -
PROOF 217 N/cm² (315 PSIA)
BURST 368 N/cm² (535 PSIA)

LEAKAGE -
INTERNAL 290 scc/HR OF GN₂ @ 217 N/cm² (315 PSIA)
EXTERNAL 1 x 10⁻³ scc/s OF GN₂ @ 368 N/cm² (535 PSIA)

SUPPLY VOLTAGE RANGE 28 Vdc
POWER REQUIREMENTS WATTS @ Vdc, °C (°F)
DIELECTRIC STRENGTH 1 mA MAXIMUM CURRENT LEAKAGE @ 1000 VOLTS rms, 60 Hz
INSULATION RESISTANCE 50 MΩ @ 50 Vdc

MAXIMUM VALVE MAGNETIC FIELD DENSITY -
ENERGIZED unknown nT @ 1 m (GAMMA @ 6 in)
DE-ENERGIZED nT @ 1 m (GAMMA @ 6 in)

NOZZLE REMOVABLE FROM VALVE
furnished by customer INTEGRAL WITH VALVE

NOZZLE AREA RATIO

MATERIALS -
CONSTRUCTION CRES
SEATS CRES Seat, Kel-F Poppet

CONNECTIONS -
INLET Modular
ELECTRICAL Connector

MASS 0.20 kg (0.46 lbm)

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

MANUFACTURER Sterer Engineering (43)

PART NUMBER 24060

PROGRAM..... Project 'FIRE'

CONTRACTING AGENCY.....

PRIME CONTRACTOR..... LTV

STATUS

QUALIFIED..... Yes

FLOWN.....

LAUNCH VEHICLE.....

AVAILABILITY.....

COST/PROCUREMENT INFORMATION...

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

PROPELLANT GN₂

VACUUM THRUST RANGE 2x10² N (5 lbf)

INLET PRESSURE RANGE 206 N/cm² (300 PSIA)

INLET TEMPERATURE RANGE -17 to 85.5 °C (0 to +860 °F)

RATED FLOW AT PRESSURE DIFFERENTIAL .. 2.8x10⁴ scc/s @ 206 N/cm², 15 °C
(60 SCFM @ 300 PSID, 60 °F)

RESPONSE -

OPEN 15 ms @ _____ Vdc, _____ N/cm² INLET PRESSURE, _____ °C
(_____ PSIA INLET PRESSURE, _____ °F)

CLOSE _____ ms @ _____ Vdc, _____ N/cm², _____ °C
(_____ PSIA, _____ °F)

MIN. COMMANDED PULSE WIDTH
(SIGNAL ON TO SIGNAL OFF) _____ ms

LIFE _____ CYCLES

PRESSURES -

PROOF 206 N/cm² (600 PSIA)

BURST 689.4 N/cm² (1000 PSIA)

LEAKAGE -

INTERNAL 0.25 scc/HR OF _____ @ _____ N/cm² (_____ PSIA)

EXTERNAL _____ scc/s OF _____ @ _____ N/cm² (_____ PSIA)

SUPPLY VOLTAGE RANGE 24-32 Vdc

POWER REQUIREMENTS _____ WATTS @ _____ Vdc, _____ °C (_____ °F)

DIELECTRIC STRENGTH _____ mA MAXIMUM CURRENT LEAKAGE @ _____ VOLTS rms, _____ Hz

INSULATION RESISTANCE _____ MΩ @ _____ Vdc

MAXIMUM VALVE MAGNETIC FIELD DENSITY -

ENERGIZED _____ nT @ 1 m (GAMMA @ 6 in)

DE-ENERGIZED _____ nT @ 1 m (GAMMA @ 6 in)

NOZZLE Yes REMOVABLE FROM VALVE
_____ INTEGRAL WITH VALVE

NOZZLE AREA RATIO _____

MATERIALS -

CONSTRUCTION _____

SEATS _____

CONNECTIONS -

INLET _____

ELECTRICAL _____

MASS _____ kg (_____ lbm)

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

MANUFACTURER Marotta Scientific Control
(53)

MODEL NO. RV80A

PART NUMBER 227174

PROGRAM..... LORV

CONTRACTING AGENCY..... Air Force

PRIME CONTRACTOR..... AVCO

STATUS

QUALIFIED..... Yes

FLOWN..... Yes

LAUNCH VEHICLE.....

AVAILABILITY.....

COST/PROCUREMENT INFORMATION...

4.3.3 VALVE, COLD GAS JET

MASS $\frac{95}{4.3.3-36}$ kg
Combination pressure regulator and solenoid valve. Regulated pressure
400 psia. $\frac{2.1}{400}$ lbm

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

MANUFACTURER Allen Design, Inc.

PART NUMBER 13535

PROGRAM..... Aerobee

CONTRACTING AGENCY.....

PRIME CONTRACTOR..... Aerojet Mfg.

STATUS

QUALIFIED..... Yes

FLOWN..... Yes

LAUNCH VEHICLE.....

AVAILABILITY.....

COST/PROCUREMENT INFORMATION... One - \$500

100 - \$235

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

GHe

PROPELLANT
VACUUM THRUST RANGE N (lb_f)
INLET PRESSURE RANGE N/cm² (PSIA)
INLET TEMPERATURE RANGE -42 to +71.1 °C (-45 to +160 °F)
RATED FLOW AT PRESSURE DIFFERENTIAL .. scc/s @ 196 N/cm², °C
(SCFM @ 285 PSID, °F)
(equiv. to 0.128 dia. orifice)
RESPONSE -
OPEN 50 ms @ 25 Vdc, 351 N/cm² INLET PRESSURE, 20 °C
(510 PSIA INLET PRESSURE, 68 °F)
CLOSE 10 ms @ 25 Vdc, 206 N/cm², 20 °C
(300 PSIA, 68 °F)
MIN. COMMANDED PULSE WIDTH
(SIGNAL ON TO SIGNAL OFF) ms
LIFE 20,000 CYCLES
PRESSURES -
PROOF 527 N/cm² (765 PSIA)
BURST 699 N/cm² (1015 PSIA)
LEAKAGE -
INTERNAL 2 x 10⁴ scc/HR OF N/cm² (PSIA)
EXTERNAL None scc/s OF N/cm² (PSIA)
SUPPLY VOLTAGE RANGE 22-32 Vdc
POWER REQUIREMENTS WATTS @ Vdc, °C (°F)
DIELECTRIC STRENGTH mA MAXIMUM CURRENT LEAKAGE @ VOLTS rms, Hz
INSULATION RESISTANCE MΩ @ Vdc
MAXIMUM VALVE MAGNETIC FIELD DENSITY -
ENERGIZED nT @ 1 m (GAMMA @ 6 in)
DE-ENERGIZED nT @ 1 m (GAMMA @ 6 in)
NOZZLE REMOVABLE FROM VALVE
..... INTEGRAL WITH VALVE
NOZZLE AREA RATIO
MATERIALS -
CONSTRUCTION
SEATS
CONNECTIONS -
INLET
ELECTRICAL
MASS 0.31 kg (0.70 lbm)
OTHER SIGNIFICANT CHARACTERISTICS May be used with cold gases or hydrazine

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

MANUFACTURER Valcor Engineering Corp. (33)

PART NUMBER V27200-510

PROGRAM..... ELMS

CONTRACTING AGENCY..... USAF

PRIME CONTRACTOR..... Grumman

STATUS

QUALIFIED..... Yes, 8/74

FLOWN.....

LAUNCH VEHICLE.....

AVAILABILITY.....

COST/PROCUREMENT INFORMATION...

4.3.3 VALVE, COLD GAS JET

 GN_2

PROPELLANT

VACUUM THRUST RANGE $\frac{133}{\text{N}}$ with nozzle ($\frac{30}{\text{lb}_f}$)

INLET PRESSURE RANGE N/cm^2 (..... PSIA)

INLET TEMPERATURE RANGE-53 to 71.1°C (-65 to 160°F)

RATED FLOW AT PRESSURE DIFFERENTIAL .. _____ scc/s @ _____ N/cm², _____ °C
.170 ESED (C_d = .65) (_____ SCFM @ _____ PSID, _____ °F)

RESPONSE -

OPEN 25 ms @ 20 Vdc, 2413 N/cm² INLET PRESSURE, °C

(3500 PSIA INLET PRESSURE, _____ °F)

CLOSE 25 ms @ 32 Vdc, 2413 N/cm², 21 °C
(3500 PSIA, 70 °F)

MIN. COMMANDED PULSE WIDTH

(SIGNAL ON TO SIGNAL OFF)

LIFE 1×10^5 CYCLES

PRESSURES -

PROOF $\frac{4964}{\text{N/cm}^2}$ ($\frac{7200}{\text{PSIA}}$)

BURST 8273.7 N/cm² (12,000 PSIA)

LEAKAGE -

INTERNAL 4 SCC/HR OF N_2 @ 2413 N/cm² (3500 PSIA)

EXTERNAL 0 scc/s OF N/cm² (..... PSIA)

SUPPLY VOLTAGE RANGE 24-32 Vdc

POWER REQUIREMENTS 60 WATTS @ 30 Vdc, 21 °C (70 °F)

DIELECTRIC STRENGTH 5 mA MAXIMUM CURRENT LEAKAGE @ 700 VOLTS rms, 60 Hz 1 min

INSULATION RESISTANCE 100 M Ω 500 Vdc

MAXIMUM VALVE MAGNETIC FIELD DENSITY -

ENERGIZED nT @ 1 m (GAMMA @ 6 in)

DE-ENERGIZED nT @ 1 m (GAMMA @ 6 in)

NOZZLE REMOVABLE FROM VALVE

_____ INTEGRAL WITH VALVE

NOZZLE AREA RATIO

MATERIALS -

CONSTRUCTION ST/ST

CONSTRUCTION	ST/ST Polyimide Buna N Stamp & Dynamic Seals
SEATS	

CONNECTIONS -

INLET MS 33649-6

ELECTRICAL PT1H 8 3P

MASS $\frac{.453}{1.00}$ kg (lbm)

OTHER SIGNIFICANT CHARACTERISTICS

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

MANUFACTURER Sterer Engineering (43)

PART NUMBER 22690

PROGRAM..... Agena

CONTRACTING AGENCY.....

PRIME CONTRACTOR..... Lockheed

STATUS

QUALIFIED..... Yes

FLOWN..... Yes

LAUNCH VEHICLE.....

AVAILABILITY.....

COST/PROCUREMENT INFORMATION...

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

PROPELLANT GN₂
 VACUUM THRUST RANGE 44 N (10 lbf)
 INLET PRESSURE RANGE 82.7 N/cm² (120 PSIA)
 INLET TEMPERATURE RANGE -53 to 93.3 °C (-65 to +200 °F)
 RATED FLOW AT PRESSURE DIFFERENTIAL .. 5.66x10⁴ scc/s @ 82.7 N/cm², 15 °C
 (120 SCFM @ 120 PSID, 60 °F)
 RESPONSE -
 OPEN 15 ms @ _____ Vdc, _____ N/cm² INLET PRESSURE, _____ °C
 (_____ PSIA INLET PRESSURE, _____ °F)
 CLOSE 15 ms @ _____ Vdc, _____ N/cm², _____ °C
 (_____ PSIA, _____ °F)
 MIN. COMMANDED PULSE WIDTH
 (SIGNAL ON TO SIGNAL OFF) _____ ms
 LIFE 2x10⁶ CYCLES
 PRESSURES -
 PROOF 165 N/cm² (240 PSIA)
 BURST 268 N/cm² (390 PSIA)
 LEAKAGE -
 INTERNAL 0.1 scc/HR OF N₂ @ _____ N/cm² (_____ PSIA)
 EXTERNAL00002 scc/s OF N₂ @ _____ N/cm² (_____ PSIA)
 SUPPLY VOLTAGE RANGE 20-28 Vdc
 POWER REQUIREMENTS _____ WATTS @ _____ Vdc, _____ °C (_____ °F)
 DIELECTRIC STRENGTH _____ mA MAXIMUM CURRENT LEAKAGE @ _____ VOLTS rms, _____ Hz
 INSULATION RESISTANCE _____ MΩ @ _____ Vdc
 MAXIMUM VALVE MAGNETIC FIELD DENSITY -
 ENERGIZED _____ nT @ 1 m (GAMMA @ 6 in)
 DE-ENERGIZED _____ nT @ 1 m (GAMMA @ 6 in)
 NOZZLE Yes REMOVABLE FROM VALVE
 _____ INTEGRAL WITH VALVE
 NOZZLE AREA RATIO _____
 MATERIALS -
 CONSTRUCTION _____
 SEATS _____
 CONNECTIONS -
 INLET _____
 ELECTRICAL _____
 MASS _____ kg (_____ lbf)

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

MANUFACTURER Wright Components, Inc. (23)

PART NUMBER 15626

PROGRAM..... Solrad II A and B

CONTRACTING AGENCY.....

PRIME CONTRACTOR..... Hamilton Standard

STATUS

QUALIFIED..... Yes

FLOWN..... Due 1975

LAUNCH VEHICLE.....

AVAILABILITY..... 18 - 24 weeks

COST/PROCUREMENT INFORMATION...

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

PROPELLANT Ammonia

VACUUM THRUST RANGE N (lbf)

INLET PRESSURE RANGE 0-251 N/cm² (0-365 PSIA)

INLET TEMPERATURE RANGE 0 to 60 °C (32 to 140 °F)

RATED FLOW AT PRESSURE DIFFERENTIAL .. scc/s @ N/cm², °C
equiv. to 0.018 dia. orifice (SCFM @ PSID, °F)
(C_d=0.8)

RESPONSE -

OPEN 15 ms @ 24 Vdc, N/cm² INLET PRESSURE, °C
(PSIA INLET PRESSURE, °F)

CLOSE 5 ms @ 24 Vdc, N/cm², °C
(PSIA, °F)

MIN. COMMANDED PULSE WIDTH
(SIGNAL ON TO SIGNAL OFF) ms

LIFE 1 x 10⁶ CYCLES

PRESSURES -

PROOF 320 N/cm² (465 PSIA)

BURST 424 N/cm² (615 PSIA)

LEAKAGE -

INTERNAL07 scc/HR OF He @ 79.2 N/cm² (115 PSIA)

EXTERNAL 1.2x10⁻⁷ scc/s OF He @ 79.2 N/cm² (115 PSIA)

SUPPLY VOLTAGE RANGE 22-26 Vdc

POWER REQUIREMENTS 3 WATTS @ 24 Vdc, 24 °C (76 °F)

DIELECTRIC STRENGTH 50 mA MAXIMUM CURRENT LEAKAGE @ VOLTS rms, Hz

INSULATION RESISTANCE 10 MΩ @ 100 Vdc

MAXIMUM VALVE MAGNETIC FIELD DENSITY -

ENERGIZED nT @ 1 m (GAMMA @ 6 in)

DE-ENERGIZED nT @ 1 m (GAMMA @ 6 in)

NOZZLE REMOVABLE FROM VALVE
 INTEGRAL WITH VALVE

NOZZLE AREA RATIO

MATERIALS -

CONSTRUCTION Stainless Steel

SEATS AFE-102

CONNECTIONS -

INLET

ELECTRICAL

MASS 0.13 kg (0.30 lbm)

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

MANUFACTURER Wright Components Inc. (23)

PART NUMBER 15749

PROGRAM..... Solrad XI

CONTRACTING AGENCY.....

PRIME CONTRACTOR..... Avco Systems Div.

STATUS

QUALIFIED..... Yes

FLOWN..... Due 1975

LAUNCH VEHICLE.....

AVAILABILITY..... 18 - 24 weeks

COST/PROCUREMENT INFORMATION...

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

PROPELLANT Ammonia

VACUUM THRUST RANGE N (lbf)

INLET PRESSURE RANGE 250 N/cm² (364 PSIA)

INLET TEMPERATURE RANGE 0 to 60 °C (32 to 140 °F)

RATED FLOW AT PRESSURE DIFFERENTIAL .. scc/s @ N/cm², °C
equiv. to 0.018 dia. orifice (SCFM @ PSID, °F)
(C_d = 0.65)

RESPONSE -

OPEN 30 ms @ 24 Vdc, N/cm² INLET PRESSURE, 23 °C
(PSIA INLET PRESSURE, 75 °F)

CLOSE 30 ms @ 24 Vdc, N/cm², 23 °C
(PSIA, 75 °F)

MIN. COMMANDED PULSE WIDTH
(SIGNAL ON TO SIGNAL OFF) ms

LIFE 1000 CYCLES

PRESSURES -

PROOF 319 N/cm² (464 PSIA)

BURST 423 N/cm² (614 PSIA)

LEAKAGE -

INTERNAL0089 cc/HR OF He @ 78.6 N/cm² (114 PSIA)

EXTERNAL 1.0 x 10⁻⁶ cc/s OF He @ 78.6 N/cm² (114 PSIA)

SUPPLY VOLTAGE RANGE 24-32 Vdc

POWER REQUIREMENTS 10 WATTS @ 24 Vdc, 24 °C (76 °F)

DIELECTRIC STRENGTH 50 mA MAXIMUM CURRENT LEAKAGE @ 500 VOLTS rms, 60 Hz

INSULATION RESISTANCE 10 MΩ @ 500 Vdc

MAXIMUM VALVE MAGNETIC FIELD DENSITY -

ENERGIZED nT @ 1 m (GAMMA @ 6 in)

DE-ENERGIZED nT @ 1 m (GAMMA @ 6 in)

NOZZLE REMOVABLE FROM VALVE
 INTEGRAL WITH VALVE

NOZZLE AREA RATIO

MATERIALS -

CONSTRUCTION Stainless Steel

SEATS AFF - 102

CONNECTIONS -

INLET

ELECTRICAL

MASS 0.18 kg (0.40 lbm)

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

MANUFACTURER Wright Components, Inc. (23)

PART NUMBER 15750

PROGRAM..... Solerad X 1

CONTRACTING AGENCY.....

PRIME CONTRACTOR..... Avco Systems Div.

STATUS

QUALIFIED..... Yes

FLOWN..... Due 1975

LAUNCH VEHICLE.....

AVAILABILITY..... 18 - 24 weeks ARO

COST/PROCUREMENT INFORMATION...

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

PROPELLANT Ammonia

VACUUM THRUST RANGE N (lbf)

INLET PRESSURE RANGE 0-251 N/cm² (0-365 PSIA)

INLET TEMPERATURE RANGE 0 to 60 °C (32 to 140 °F)

RATED FLOW AT PRESSURE DIFFERENTIAL .. scc/s @ N/cm², °C
equiv. to 0.018" dia orifice (SCFM @ PSID, °F)
(C_d = 0.8)

RESPONSE -

OPEN 15 ms @ 24 Vdc, 251 N/cm² INLET PRESSURE, °C
(365 PSIA INLET PRESSURE, °F)

CLOSE 15 ms @ 24 Vdc, 251 N/cm², °C
(365 PSIA, °F)

MIN. COMMANDED PULSE WIDTH
(SIGNAL ON TO SIGNAL OFF) ms

LIFE 1 x 10⁶ CYCLES

PRESSURES -

PROOF 320 N/cm² (465 PSIA)

BURST 424 N/cm² (615 PSIA)

LEAKAGE -

INTERNAL0089 scc/HR OF He @ 79.2 N/cm² (115 PSIA)

EXTERNAL 5.0 x 10⁻⁷ scc/s OF He @ 79.2 N/cm² (115 PSIA)

SUPPLY VOLTAGE RANGE 22-28 Vdc

POWER REQUIREMENTS 3 WATTS @ 24 Vdc, 24 °C (76 °F)

DIELECTRIC STRENGTH 50 mA MAXIMUM CURRENT LEAKAGE @ 500 VOLTS rms, 60 Hz

INSULATION RESISTANCE 10 MΩ @ 500 Vdc

MAXIMUM VALVE MAGNETIC FIELD DENSITY -

ENERGIZED nT @ 1 m (GAMMA @ 6 in)

DE-ENERGIZED nT @ 1 m (GAMMA @ 6 in)

NOZZLE REMOVABLE FROM VALVE
 INTEGRAL WITH VALVE

NOZZLE AREA RATIO

MATERIALS -

CONSTRUCTION Stainless Steel

SEATS AFE-102

CONNECTIONS -

INLET

ELECTRICAL

MASS13 kg (0.30 lbm)

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

MANUFACTURER Colt Industries (50)

PART NUMBER CRTC-6



PROGRAM..... STRYTI - Spinning Payload Attitude Control
System and Classified research rocket
applications

CONTRACTING AGENCY..... _____

PRIME CONTRACTOR..... Sandia

STATUS

QUALIFIED..... _____

FLOWN..... Yes

LAUNCH VEHICLE..... _____

AVAILABILITY..... _____

COST/PROCUREMENT INFORMATION... _____

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

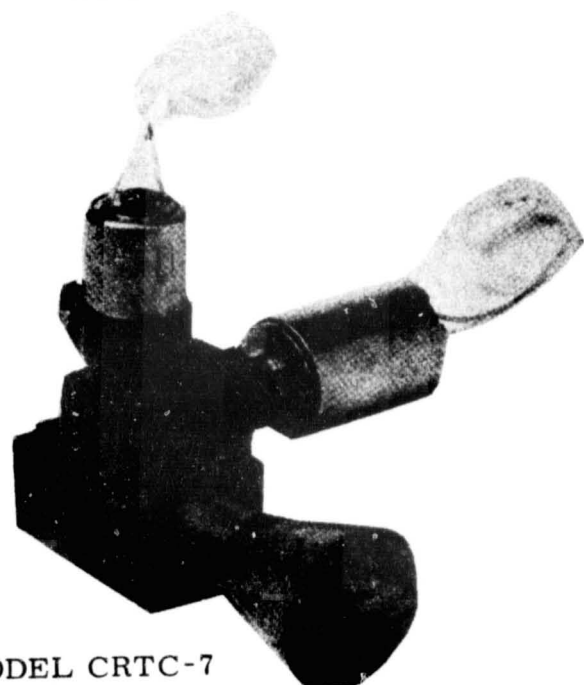
PROPELLANT	<u>GN₂</u>	
VACUUM THRUST RANGE	<u>88</u> N	(<u>20</u> lbf)
INLET PRESSURE RANGE	<u>65</u> N/cm ²	(<u>150</u> PSIA)
INLET TEMPERATURE RANGE	<u>-28 to 5</u> °C	(<u>-20 to 50</u> °F)
RATED FLOW AT PRESSURE DIFFERENTIAL ..	<u> </u> scc/s @ <u> </u> N/cm ² , <u> </u> °C	(<u> </u> SCFM @ <u> </u> PSID, <u> </u> °F)
RESPONSE -		
OPEN	<u>20</u> ms @ <u>28</u> Vdc, <u> </u> N/cm ² INLET PRESSURE, <u> </u> °C	(<u> </u> PSIA INLET PRESSURE, <u> </u> °F)
CLOSE	<u>20</u> ms @ <u> </u> Vdc, <u> </u> N/cm ² , <u> </u> °C	(<u> </u> PSIA, <u> </u> °F)
MIN. COMMANDED PULSE WIDTH (SIGNAL ON TO SIGNAL OFF)	<u>20</u> ms	
LIFE	<u> </u> CYCLES	
PRESSURES -		
PROOF	<u>517</u> N/cm ²	(<u>750</u> PSIA)
BURST	<u>827.3</u> N/cm ²	(<u>1200</u> PSIA)
LEAKAGE -		
INTERNAL	<u>Minimal</u> scc/HR OF <u> </u> @ <u> </u> N/cm ² (<u> </u> PSIA)	
EXTERNAL	<u> </u> scc/s OF <u> </u> @ <u> </u> N/cm ² (<u> </u> PSIA)	
SUPPLY VOLTAGE RANGE	<u>28</u> Vdc @ 1 Amp level	
POWER REQUIREMENTS	<u> </u> WATTS @ <u> </u> Vdc, <u> </u> °C (<u> </u> °F)	
DIELECTRIC STRENGTH	<u> </u> mA MAXIMUM CURRENT LEAKAGE @ <u> </u> VOLTS rms, <u> </u> Hz	
INSULATION RESISTANCE	<u> </u> MΩ @ <u> </u> Vdc	
MAXIMUM VALVE MAGNETIC FIELD DENSITY -		
ENERGIZED	<u> </u> nT @ 1 m (GAMMA @ 6 in)	
DE-ENERGIZED	<u> </u> nT @ 1 m (GAMMA @ 6 in)	
NOZZLE	<u>Yes</u> REMOVABLE FROM VALVE	
	<u> </u> INTEGRAL WITH VALVE	
NOZZLE AREA RATIO	<u> </u>	
MATERIALS -		
CONSTRUCTION	<u> </u>	
SEATS	<u> </u>	
CONNECTIONS -		
INLET	<u> </u>	
ELECTRICAL	<u> </u>	
MASS	<u> </u> kg	(<u> </u> lbm)

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

MANUFACTURER Colt Industries (50)

PART NUMBER CRTC-7



MODEL CRTC-7
COLD GAS REACTION THRUST CONTROL

PROGRAM..... Classified research rocket applications

CONTRACTING AGENCY..... _____

PRIME CONTRACTOR..... Sandia

STATUS

QUALIFIED..... _____

FLOWN..... Yes

LAUNCH VEHICLE..... _____

AVAILABILITY..... _____

COST/PROCUREMENT INFORMATION... _____

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

PROPELLANT	<u>GN₂</u>	
VACUUM THRUST RANGE	<u>22-111</u> N 2 pre-adjusted levels	(<u>5-25</u> lbf)
INLET PRESSURE RANGE	<u>344</u> N/cm ²	(<u>500</u> PSIA)
INLET TEMPERATURE RANGE	<u>-28 to 65</u> °C	(<u>-20 to 120</u> °F)
RATED FLOW AT PRESSURE DIFFERENTIAL ..	_____ scc/s @ _____ N/cm ² , _____ °C (_____ SCFM @ _____ PSID, _____ °F)	
RESPONSE -		
OPEN	<u>20</u> ms @ <u>28</u> Vdc, _____ N/cm ² INLET PRESSURE, _____ °C	(_____ PSIA INLET PRESSURE, _____ °F)
CLOSE	<u>20</u> ms @ _____ Vdc, _____ N/cm ² , _____ °C	(_____ PSIA, _____ °F)
MIN. COMMANDED PULSE WIDTH (SIGNAL ON TO SIGNAL OFF)	<u>20</u> ms	
LIFE	_____ CYCLES	
PRESSURES -		
PROOF	<u>517</u> N/cm ²	(<u>750</u> PSIA)
BURST	<u>827.3</u> N/cm ²	(<u>1200</u> PSIA)
LEAKAGE -		
INTERNAL	<u>Minimal</u> scc/HR OF _____ @ _____ N/cm ² (_____ PSIA)	
EXTERNAL	_____ scc/s OF _____ @ _____ N/cm ² (_____ PSIA)	
SUPPLY VOLTAGE RANGE	<u>28</u> Vdc @ 1 Amp level	
POWER REQUIREMENTS	_____ WATTS @ _____ Vdc, _____ °C (_____ °F)	
DIELECTRIC STRENGTH	_____ mA MAXIMUM CURRENT LEAKAGE @ _____ VOLTS rms, _____ Hz	
INSULATION RESISTANCE	_____ MΩ @ _____ Vdc	
MAXIMUM VALVE MAGNETIC FIELD DENSITY -		
ENERGIZED	_____ nT @ 1 m (GAMMA @ 6 in)	
DE-ENERGIZED	_____ nT @ 1 m (GAMMA @ 6 in)	
NOZZLE	<u>Yes</u> REMOVABLE FROM VALVE _____ INTEGRAL WITH VALVE	
NOZZLE AREA RATIO	_____	
MATERIALS -		
CONSTRUCTION	_____	
SEATS	_____	
CONNECTIONS -		
INLET	_____	
ELECTRICAL	_____	
MASS	_____ kg	(_____ lbm)

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

MANUFACTURER Colt Industries (50)

PART NUMBER CRTS-2

PROGRAM..... SPACS and HARP

CONTRACTING AGENCY.....

PRIME CONTRACTOR..... Sandia, Canadian Government

STATUS

QUALIFIED.....

FLOWN..... Yes

LAUNCH VEHICLE.....

AVAILABILITY.....

COST/PROCUREMENT INFORMATION...

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

PROPELLANT GN₂
 VACUUM THRUST RANGE 35 N @ 217 N/cm² (315 psia) 8.0 lbf)
 INLET PRESSURE RANGE N/cm² (PSIA)
 INLET TEMPERATURE RANGE -53 to 71 °C (-65 to 160 °F)
 RATED FLOW AT PRESSURE DIFFERENTIAL .. scc/s @ N/cm², °C
 (SCFM @ PSID, °F)
 RESPONSE -
 OPEN 20 ms @ 28 Vdc, N/cm² INLET PRESSURE, °C
 (PSIA INLET PRESSURE, °F)
 CLOSE 20 ms @ Vdc, N/cm², °C
 (PSIA, °F)
 MIN. COMMANDED PULSE WIDTH
 (SIGNAL ON TO SIGNAL OFF) 20 ms
 LIFE CYCLES
 PRESSURES -
 PROOF 517 N/cm² (750 PSIA)
 BURST 827.3 N/cm² (1200 PSIA)
 LEAKAGE -
 INTERNAL Minimal scc/HR OF @ N/cm² (PSIA)
 EXTERNAL scc/s OF @ N/cm² (PSIA)
 SUPPLY VOLTAGE RANGE 28 Vdc @ 1 Amp level
 POWER REQUIREMENTS WATTS @ Vdc, °C (°F)
 DIELECTRIC STRENGTH mA MAXIMUM CURRENT LEAKAGE @ VOLTS rms, Hz
 INSULATION RESISTANCE MΩ @ Vdc
 MAXIMUM VALVE MAGNETIC FIELD DENSITY -
 ENERGIZED nT @ 1 m (GAMMA @ 6 in)
 DE-ENERGIZED nT @ 1 m (GAMMA @ 6 in)
 NOZZLE Yes REMOVABLE FROM VALVE
 INTEGRAL WITH VALVE
 NOZZLE AREA RATIO
 MATERIALS -
 CONSTRUCTION
 SEATS
 CONNECTIONS -
 INLET
 ELECTRICAL
 MASS kg (lbm)

186

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

MANUFACTURER Fairchild Industries
Stratos Division (31)

PART NUMBER 683000

PROGRAM..... OAD

CONTRACTING AGENCY..... NASA

PRIME CONTRACTOR..... GAC

STATUS

QUALIFIED..... Yes

FLOWN..... Yes

LAUNCH VEHICLE..... Atlas Centaur

AVAILABILITY..... Not in production. Available on special order.

COST/PROCUREMENT INFORMATION...

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

PROPELLANT GN₂

VACUUM THRUST RANGE 34.2 - 38.4 $\frac{N}{cm^2}$ (49.7 - 55.7 $\frac{lb_f}{PSIA}$)

INLET PRESSURE RANGE -62 to 65.5 $^{\circ}C$ (-80 to 150 $^{\circ}F$)

INLET TEMPERATURE RANGE

RATED FLOW AT PRESSURE DIFFERENTIAL .. scc/s @ $\frac{N}{cm^2}$, $^{\circ}C$
(SCFM @ PSID, $^{\circ}F$)

RESPONSE -

OPEN 35 ms @ 22 Vdc, 38.4 $\frac{N}{cm^2}$ INLET PRESSURE, 65.5 $^{\circ}C$
(55.7 PSIA INLET PRESSURE, 150 $^{\circ}F$)

CLOSE 20 ms @ 35 Vdc, 32.4 $\frac{N}{cm^2}$, -62 $^{\circ}C$
(49.7 PSIA, -80 $^{\circ}F$)

MIN. COMMANDED PULSE WIDTH
(SIGNAL ON TO SIGNAL OFF) ms

LIFE 50,000 CYCLES

PRESSURES -

PROOF 148 $\frac{N}{cm^2}$ (215 PSIA)

BURST 182 $\frac{N}{cm^2}$ (265 PSIA)

LEAKAGE -

INTERNAL 2 scc/HR OF GN₂ @ $\frac{N}{cm^2}$ (PSIA)

EXTERNAL scc/s OF @ $\frac{N}{cm^2}$ (PSIA)

SUPPLY VOLTAGE RANGE 22-35 Vdc

POWER REQUIREMENTS 28 WATTS @ 28 Vdc, 23 $^{\circ}C$ (75 $^{\circ}F$)

DIELECTRIC STRENGTH mA MAXIMUM CURRENT LEAKAGE @ VOLTS rms, Hz

INSULATION RESISTANCE M Ω @ Vdc

MAXIMUM VALVE MAGNETIC FIELD DENSITY -

ENERGIZED nT @ 1 m (GAMMA @ 6 in)

DE-ENERGIZED nT @ 1 m (GAMMA @ 6 in)

NOZZLE REMOVABLE FROM VALVE
 INTEGRAL WITH VALVE

NOZZLE AREA RATIO

MATERIALS -

CONSTRUCTION 430 S.S., 300 Series Cres

SEATS Silicon Rubber

CONNECTIONS -

INLET

ELECTRICAL

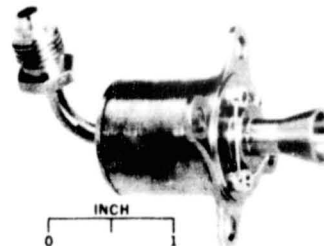
MASS 0.34 kg (0.75 lbm)

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

MANUFACTURER Futurecraft (54)

PART NUMBER _____



PROGRAM..... Classified

CONTRACTING AGENCY..... Air Force

PRIME CONTRACTOR..... RCA Astroelectronics Division

STATUS

QUALIFIED..... _____

FLOWN..... _____

LAUNCH VEHICLE..... _____

AVAILABILITY..... _____

COST/PROCUREMENT INFORMATION... _____

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

PROPELLANT GN₂
 VACUUM THRUST RANGE 8.8 N (2.0 lbf)
 INLET PRESSURE RANGE 320 N/cm² (465 PSIA)
 INLET TEMPERATURE RANGE -6.6 to 48.8 °C (20 to 120 °F)
 RATED FLOW AT PRESSURE DIFFERENTIAL .. scc/s @ N/cm², °C
 (SCFM @ PSID, °F)
 RESPONSE -
 OPEN < 10 ms @ 28 Vdc, N/cm² INLET PRESSURE, °C
 (PSIA INLET PRESSURE, °F)
 CLOSE < 10 ms @ 28 Vdc, N/cm², °C
 (PSIA, °F)
 MIN. COMMANDED PULSE WIDTH
 (SIGNAL ON TO SIGNAL OFF) ms
 LIFE 10,000 CYCLES
 PRESSURES -
 PROOF N/cm² (PSIA)
 BURST N/cm² (PSIA)
 LEAKAGE -
 INTERNAL < 3 scc/HR OF GN₂ @ 10.1-320 N/cm² (14.7 - 465 PSIA)
 EXTERNAL scc/s OF @ N/cm² (PSIA)
 SUPPLY VOLTAGE RANGE Vdc
 POWER REQUIREMENTS < 30 WATTS @ 28 Vdc, 20 °C (°F)
 DIELECTRIC STRENGTH mA MAXIMUM CURRENT LEAKAGE @ VOLTS rms, Hz
 INSULATION RESISTANCE MΩ @ Vdc
 MAXIMUM VALVE MAGNETIC FIELD DENSITY -
 ENERGIZED nT @ 1 m (GAMMA @ 6 in)
 DE-ENERGIZED nT @ 1 m (GAMMA @ 6 in)
 NOZZLE yes REMOVABLE FROM VALVE
 INTEGRAL WITH VALVE
 NOZZLE AREA RATIO
 MATERIALS -
 CONSTRUCTION
 SEATS
 CONNECTIONS -
 INLET
 ELECTRICAL Nominal 28 VDC
 MASS 0.11 kg (0.25 lbm)

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

MANUFACTURER Wright Components, Inc. (23)

PART NUMBER 15398

PROGRAM..... ATS D/E

CONTRACTING AGENCY.....

PRIME CONTRACTOR..... Avco Systems Div.

STATUS

QUALIFIED..... Yes

FLOWN..... Yes

LAUNCH VEHICLE.....

AVAILABILITY..... 18 - 24 weeks

COST/PROCUREMENT INFORMATION...

4.3.3 VALVE, COLD GAS JET

PROPELLANT Ammonia

VACUUM THRUST RANGE N (lbf)

INLET PRESSURE RANGE 0-217 N/cm² (0-315 PSIA)

INLET TEMPERATURE RANGE 35 to 51.6 °C fluid (95 to 125 °F)
-17.78 to 51.67 ambient (0 to 125 °F)

RATED FLOW AT PRESSURE DIFFERENTIAL .. scc/s @ N/cm², °C *
(SCFM @ PSID, °F)

RESPONSE -

OPEN 15 ms @ Vdc, N/cm² INLET PRESSURE, °C
(PSIA INLET PRESSURE, °F)

CLOSE 15 ms @ Vdc, N/cm², °C
(PSIA, °F)

MIN. COMMANDED PULSE WIDTH
(SIGNAL ON TO SIGNAL OFF) ms

LIFE 2000 HOURS

PRESSURES -

PROOF 286 N/cm² (415 PSIA)

BURST 492 N/cm² (715 PSIA)

LEAKAGE -

INTERNAL 2.1 scc/HR OF He @ 137 N/cm² (PSIA) 200 psid

EXTERNAL 6 x 10⁻⁵ scc/s OF He @ 137 N/cm² (PSIA) 200 psid

SUPPLY VOLTAGE RANGE 18-28 Vdc

POWER REQUIREMENTS 1 WATTS @ 24 Vdc, 21 °C (70 °F)

DIELECTRIC STRENGTH 50 mA MAXIMUM CURRENT LEAKAGE @ 500 VOLTS rms, 60 Hz

INSULATION RESISTANCE 10 MΩ @ 500 Vdc

MAXIMUM VALVE MAGNETIC FIELD DENSITY -

ENERGIZED nT @ 1 m (GAMMA @ 6 in)

DE-ENERGIZED nT @ 1 m (GAMMA @ 6 in)

NOZZLE REMOVABLE FROM VALVE
 INTEGRAL WITH VALVE

NOZZLE AREA RATIO

MATERIALS -

CONSTRUCTION Stainless Steel

SEATS EPR-515-8

CONNECTIONS -

INLET

ELECTRICAL

MASS 0.11 kg (0.25 lbm)

OTHER SIGNIFICANT CHARACTERISTICS * Rated Flow at Pressure Diff.
Dash {-2 and -4} equiv to 0.18 orifice dia:
Dash {-1 and -3} equiv to 0.18 orifice dia:

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

MANUFACTURER Wright Components, Inc. (23)

PART NUMBER 15457

PROGRAM.....

CONTRACTING AGENCY..... NASA/Goddard

PRIME CONTRACTOR.....

STATUS

QUALIFIED..... Yes

FLOWN..... Yes

LAUNCH VEHICLE.....

AVAILABILITY..... 18-24 weeks ARO

COST/PROCUREMENT INFORMATION...

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

N_2 , He, CF_4 (Freon 14), NH_3

PROPELLANT
 VACUUM THRUST RANGE 27 N/cm² (40 PSIA)
 INLET PRESSURE RANGE
 INLET TEMPERATURE RANGE -40 to 51.6 °C (-40 to 125 °F)
 RATED FLOW AT PRESSURE DIFFERENTIAL .. 10⁻³ pps
 (1 scc/s @ 1 N/cm², 24 °C)
 (2 SCFM @ 2 PSID, 76 °F)
 RESPONSE -
 OPEN 15 ms @ Vdc, N/cm² INLET PRESSURE, °C
 (PSIA INLET PRESSURE, °F)
 CLOSE 15 ms @ Vdc, N/cm², °C
 (PSIA, °F)
 MIN. COMMANDED PULSE WIDTH
 (SIGNAL ON TO SIGNAL OFF) ms
 LIFE 2000 ~~CYCLES~~ Hours
 PRESSURES -
 PROOF N/cm² (105 PSIA)
 BURST N/cm² (255 PSIA)
 LEAKAGE -
 INTERNAL216 scc/HR OF He @ 51 N/cm² (75 PSIA)
 EXTERNAL 6 x 10⁻⁵ scc/s OF He @ 51 N/cm² (75 PSIA)
 SUPPLY VOLTAGE RANGE 28 Vdc nominal
 POWER REQUIREMENTS 2 WATTS @ 26 Vdc, 24 °C (76 °F)
 DIELECTRIC STRENGTH 50 mA MAXIMUM CURRENT LEAKAGE @ 500 VOLTS rms, 60 Hz
 INSULATION RESISTANCE 10 MΩ @ 100 Vdc
 MAXIMUM VALVE MAGNETIC FIELD DENSITY -
 ENERGIZED nT @ 1 m (GAMMA @ 6 in)
 DE-ENERGIZED nT @ 1 m (GAMMA @ 6 in)
 NOZZLE REMOVABLE FROM VALVE
 INTEGRAL WITH VALVE
 NOZZLE AREA RATIO
 MATERIALS -
 CONSTRUCTION Stainless Steel
 SEATS EPR 515-8
 CONNECTIONS -
 INLET
 ELECTRICAL
 MASS 0.11 kg (0.25 lbm)



ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

MANUFACTURER Wright Components Inc. (23)

PART NUMBER 15609



PROGRAM..... RAE-B

CONTRACTING AGENCY.....

PRIME CONTRACTOR..... NASA/Goddard Space Flight Center

STATUS

QUALIFIED..... Yes

FLOWN..... Yes

LAUNCH VEHICLE.....

AVAILABILITY..... 18-24 weeks ARO

COST/PROCUREMENT INFORMATION...

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

CF₄ (Freon 14)

PROPELLANT
 VACUUM THRUST RANGE N (lb_f)
 INLET PRESSURE RANGE N/cm² (PSIA)
 INLET TEMPERATURE RANGE °C (°F)
 RATED FLOW AT PRESSURE DIFFERENTIAL .. scc/s @ 3 N/cm², 24 °C
 4.45 x 10⁻³ PPS Freon 14 (SCFM @ 5 PSID, 76 °F)
 RESPONSE -
 OPEN 30 ms @ 28 Vdc, 27 N/cm² INLET PRESSURE, 24 °C
 (40 PSIA INLET PRESSURE, 76 °F)
 CLOSE 20 ms @ 28 Vdc, 27 N/cm², 24 °C
 (40 PSIA, 76 °F)
 MIN. COMMANDED PULSE WIDTH
 (SIGNAL ON TO SIGNAL OFF) ms
 LIFE 2000 ~~cycles~~ Hours (5 yr)
 PRESSURES -
 PROOF 72.3 N/cm² (105 PSIA)
 BURST 175 N/cm² (255 PSIA)
 LEAKAGE -
 INTERNAL 3 x 10⁻² scc/HR OF He @ 41 N/cm² (60 PSIA)
 EXTERNAL 6 x 10⁻⁵ scc/s OF He @ 41 N/cm² (60 PSIA)
 SUPPLY VOLTAGE RANGE 28 Vdc
 POWER REQUIREMENTS 2.5 WATTS @ 26 Vdc, 24 °C (76 °F)
 DIELECTRIC STRENGTH5 mA MAXIMUM CURRENT LEAKAGE @ 500 VOLTS rms, 60 Hz
 INSULATION RESISTANCE 5 MΩ @ 500 Vdc
 MAXIMUM VALVE MAGNETIC FIELD DENSITY -
 ENERGIZED nT @ 1 m (GAMMA @ 6 in)
 DE-ENERGIZED nT @ 1 m (GAMMA @ 6 in)
 NOZZLE REMOVABLE FROM VALVE
 INTEGRAL WITH VALVE
 NOZZLE AREA RATIO
 MATERIALS -
 CONSTRUCTION Stainless steel
 SEATS EPR 515-8
 CONNECTIONS -
 INLET
 ELECTRICAL
 MASS498 kg (1.10 lbm)
 OTHER SIGNIFICANT CHARACTERISTICS Filtration requirements - 5 microns s.s.

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

MANUFACTURER Wright Components, Inc. (23)

PART NUMBER 15751

PROGRAM..... ELMS

CONTRACTING AGENCY.....

PRIME CONTRACTOR..... Grumman Aerospace Corp.

STATUS

QUALIFIED..... Begins 7/74

FLOWN..... Due 6/75

LAUNCH VEHICLE.....

AVAILABILITY..... 18-24 weeks ARO

COST/PROCUREMENT INFORMATION...

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.3.3 VALVE, COLD GAS JET

PROPELLANT	GN ₂ , GHe	
VACUUM THRUST RANGE	<u>.22</u> N	(<u>.05</u> lbf)
INLET PRESSURE RANGE	_____ N/cm ²	(_____ PSIA)
INLET TEMPERATURE RANGE	_____ °C	(_____ °F)
RATED FLOW AT PRESSURE DIFFERENTIAL ..	_____ scc/s @ _____ N/cm ² , _____ °C (_____ SCFM @ _____ PSID, _____ °F)	
RESPONSE -		
OPEN	<u>20</u> ms @ _____ Vdc, _____ N/cm ² INLET PRESSURE, _____ °C	(_____ PSIA INLET PRESSURE, _____ °F)
CLOSE	<u>20</u> ms @ _____ Vdc, _____ N/cm ² , _____ °C	(_____ PSIA, _____ °F)
MIN. COMMANDED PULSE WIDTH (SIGNAL ON TO SIGNAL OFF)	_____ ms	
LIFE	<u>5 x 10⁵</u> CYCLES	
PRESSURES -		
PROOF	<u>147</u> N/cm ²	(<u>214</u> PSIA)
BURST	<u>182</u> N/cm ²	(<u>264</u> PSIA)
LEAKAGE -		
INTERNAL	<u>2</u> scc/HR OF <u>He</u> @ _____ N/cm ² (_____ PSIA)	
EXTERNAL	<u>5 x 10⁻⁴</u> scc/s OF <u>He</u> @ _____ N/cm ² (_____ PSIA)	
SUPPLY VOLTAGE RANGE	<u>28</u> Vdc	
POWER REQUIREMENTS	_____ WATTS @ _____ Vdc, _____ °C (_____ °F)	
DIELECTRIC STRENGTH	<u>.5</u> mA MAXIMUM CURRENT LEAKAGE @ <u>500</u> VOLTS rms, <u>60</u> Hz	
INSULATION RESISTANCE	<u>10</u> MΩ @ <u>500</u> Vdc	
MAXIMUM VALVE MAGNETIC FIELD DENSITY -		
ENERGIZED	_____ nT @ 1 m (GAMMA @ 6 in)	
DE-ENERGIZED	_____ nT @ 1 m (GAMMA @ 6 in)	
NOZZLE	_____ REMOVABLE FROM VALVE _____ INTEGRAL WITH VALVE	
NOZZLE AREA RATIO	_____	
MATERIALS -		
CONSTRUCTION	<u>Stainless steel</u>	
SEATS	<u>Fluorosilicone</u>	
CONNECTIONS -		
INLET	_____	
ELECTRICAL	_____	
MASS	<u>0.27</u> kg	(<u>0.60</u> lbm)

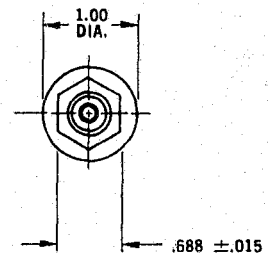
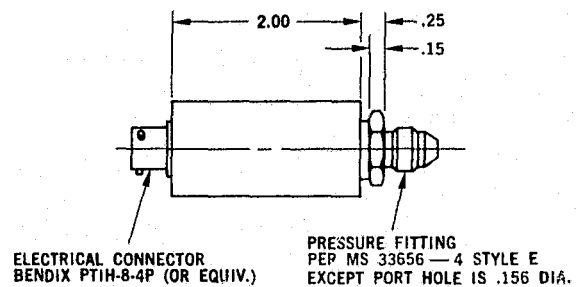
ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.4.1 TRANSDUCER, PRESSURE

MANUFACTURER Bourns, Inc. (56)

MODEL NO. 2309

PART NUMBER 2023090400



PROGRAM.....

CONTRACTING AGENCY.....

PRIME CONTRACTOR.....

STATUS

QUALIFIED..... Yes

FLOWN.....

LAUNCH VEHICLE.....

AVAILABILITY..... 90 days ARO

COST/PROCUREMENT INFORMATION... 1 to 5 units - \$825

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.4.1 TRANSDUCER, PRESSURE

OPERATING PRINCIPLE	<u>Integral electronic package, electronic isolated</u> <u>Rugged, variable reluctance</u> from sensor	
DESIGN USE		
OPERATING PRESSURE RANGE	<u>0 - 34</u> N/cm ²	(<u>0 - 50</u> PSIA)
OPERATING TEMPERATURE RANGE	<u>-53 to 933</u> °C	(<u>-65 to +200</u> °F)
OUTPUT VOLTAGE RANGE	<u>0 - 5</u> Vdc	
TIME CONSTANT	_____ sec	
DEAD VOLUME	_____ cm ³	(_____ in ³)
THERMAL SENSITIVITY SHIFT	± _____ % OF FULL SCALE/°C	
THERMAL ZERO SHIFT	± _____ % OF FULL SCALE/°C	
LINEARITY	± <u>.50</u> % OF FULL SCALE	
HYSTERESIS	± <u>.50</u> % OF FULL SCALE	
REPEATABILITY	± <u>.50</u> % OF FULL SCALE	
ACCELERATION ERROR	<u>.05</u> % OF FULL SCALE/G	
VIBRATION ERROR	<u>.05</u> % OF FULL SCALE/G	
LIFE	<u>100,000</u> CYCLES	
SUPPLY VOLTAGE RANGE	<u>22-32</u> VOLTS dc	
SUPPLY CURRENT RANGE	_____ AMPERES	
INSULATION RESISTANCE	<u>100</u> MΩ @ <u>50</u> Vdc	
OUTPUT IMPEDENCE	<u>50</u> Ohms	
OUTPUT REGULATION	_____ % CHANGE IN OUTPUT OVER THE FULL RANGE OF INPUT VOLTAGE	
PROOF PRESSURE	_____ N/cm ²	(_____ PSIA)
BURST PRESSURE	_____ N/cm ²	(_____ PSIA)
EXTERNAL LEAKAGE	_____ scc/s OF _____ @ _____ N/cm ²	(_____ PSIA)
MATERIALS	_____	
MOUNTING PROVISIONS	_____	
CONNECTIONS -		
ELECTRICAL	<u>Bendix PT1H-8-4P</u>	
PRESSURE	<u>Per MS 33656-4 Style E</u>	
MASS	<u>.1</u> kg	(<u>.3</u> lbm)
OTHER SIGNIFICANT CHARACTERISTICS ...		

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OF POOR QUALITY

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.4.1 TRANSDUCER, PRESSURE

MANUFACTURER Gould, Inc.
Statham Instruments Div. (34)

PART NUMBER PA850-150-17575

PROGRAM..... Minuteman III, PSRE

CONTRACTING AGENCY..... USAF

PRIME CONTRACTOR..... Bell Aerospace

STATUS

 QUALIFIED..... Yes

 FLOWN..... Yes

 LAUNCH VEHICLE..... Minuteman III

AVAILABILITY.....

COST/PROCUREMENT INFORMATION...

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.4.1 TRANSDUCER, PRESSURE

OPERATING PRINCIPLE	<u>Strain gage</u>	
DESIGN USE	<u>Vacuum deposited thin film</u>	
OPERATING PRESSURE RANGE	<u>103</u> N/cm ²	(<u>150</u> PSIA)
OPERATING TEMPERATURE RANGE	<u>-18 to +178</u> °C	(<u>0 to +350</u> °F)
OUTPUT VOLTAGE RANGE	<u>0-50 in</u> V _{dc}	
TIME CONSTANT	<u>< .001</u> sec	
DEAD VOLUME	<u>3x10⁻⁷</u> cm ³	(<u>.02</u> in ³)
THERMAL SENSITIVITY SHIFT	<u>±.009</u> % OF FULL SCALE/°C	
THERMAL ZERO SHIFT	<u>±.009</u> % OF FULL SCALE/°C	
LINEARITY	<u>± 0.3</u> % OF FULL SCALE	
HYSTERESIS	<u>± 0.25</u> % OF FULL SCALE	
REPEATABILITY	<u>± 0.15</u> % OF FULL SCALE	
ACCELERATION ERROR	<u>< .01</u> % OF FULL SCALE/G	
VIBRATION ERROR	<u>< .01</u> % OF FULL SCALE/G	
LIFE	<u>Unlimited</u> CYCLES	
SUPPLY VOLTAGE RANGE	<u>20</u> VOLTS dc	
SUPPLY CURRENT RANGE	<u>.015</u> AMPERES	
INSULATION RESISTANCE	<u>1000</u> MΩ @ <u>50</u> V _{dc}	
OUTPUT IMPEDENCE	<u>1000</u> Ohms	
OUTPUT REGULATION	<u>N/A</u> % CHANGE IN OUTPUT OVER THE FULL RANGE OF INPUT VOLTAGE	
PROOF PRESSURE	<u>206</u> N/cm ²	(<u>300</u> PSIA)
BURST PRESSURE	<u>689</u> N/cm ²	(<u>1000</u> PSIA)
EXTERNAL LEAKAGE	<u>1 x 10⁻⁷</u> scc/s OF <u>He</u> @ <u>206</u> N/cm ²	(<u>300</u> PSIA)
MATERIALS	<u>17-7, 17-4 300 series stainless steel</u>	
MOUNTING PROVISIONS	<u>integral flange</u>	
CONNECTIONS -		
ELECTRICAL	<u>NAS 1599</u>	
PRESSURE	<u>5/16 - 24 external</u>	
MASS	<u>.054</u> kg	(<u>.12</u> lbm)

OTHER SIGNIFICANT CHARACTERISTICS ...

Transducer utilizes all welded internal construction without solder. Outer case is all electron beam welded, hermetically sealed, stainless steel construction.

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.4.1 TRANSDUCER, PRESSURE

MANUFACTURER Gould, Inc.
Statham Instruments Div. (34)

PART NUMBER PA493 Thin Film Amplibridge
Pressure Transducer

PROGRAM..... Delta

CONTRACTING AGENCY..... TRW Systems Group

PRIME CONTRACTOR..... NASA

STATUS

QUALIFIED..... by customer

FLOWN.....

LAUNCH VEHICLE..... Delta

AVAILABILITY.....

COST/PROCUREMENT INFORMATION...

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.4.1 TRANSDUCER, PRESSURE

OPERATING PRINCIPLE	<u>Strain gage</u>	
DESIGN USE	<u>Vacuum deposited thin film and amplibridge electronics</u>	
OPERATING PRESSURE RANGE	<u>137</u> N/cm ²	(<u>200</u> PSIA)
OPERATING TEMPERATURE RANGE	<u>-7 to 93</u> °C	(<u>20 to 200</u> °F)
OUTPUT VOLTAGE RANGE	<u>-05</u> Vdc	
TIME CONSTANT	<u>.002</u> sec	
DEAD VOLUME	<u>6x10⁻⁷</u> cm ³	(<u>.04</u> in ³)
THERMAL SENSITIVITY SHIFT	* <u>±</u> % OF FULL SCALE/°C	
THERMAL ZERO SHIFT	* <u>±</u> % OF FULL SCALE/°C	
LINEARITY	** <u>±</u> % OF FULL SCALE	
HYSTERESIS	** <u>±</u> % OF FULL SCALE	
REPEATABILITY	** <u>±</u> % OF FULL SCALE	
ACCELERATION ERROR	<u>0.01</u> % OF FULL SCALE/G	
VIBRATION ERROR	<u>0.01</u> % OF FULL SCALE/G	
LIFE	<u>unlimited</u> CYCLES	
SUPPLY VOLTAGE RANGE	<u>25-31</u> VOLTS dc	
SUPPLY CURRENT RANGE	<u>.015</u> AMPERES	
INSULATION RESISTANCE	<u>100</u> MΩ @ <u>50</u> Vdc	
OUTPUT IMPEDENCE	<u>100</u> Ohms	
OUTPUT REGULATION	** <u> </u> % CHANGE IN OUTPUT OVER THE FULL RANGE OF INPUT VOLTAGE	
PROOF PRESSURE	<u>275</u> N/cm ²	(<u>400</u> PSIA)
BURST PRESSURE	<u>3447</u> N/cm ²	(<u>5000</u> PSIA)
EXTERNAL LEAKAGE	<u>1x10⁻⁸</u> scc/s OF <u>He</u> @ <u>275</u> N/cm ²	(<u>400</u> PSIA)
MATERIALS	<u>17-4 PH exposed to the pressure media</u>	
MOUNTING PROVISIONS	<u>none</u>	
CONNECTIONS -	Per MIL-C-26482	
ELECTRICAL	<u>7/16-20 external fitting per MS33656E4</u>	
PRESSURE		
MASS	<u>.15</u> kg	(<u>.35</u> lbm)
OTHER SIGNIFICANT CHARACTERISTICS ...		

* Output shall fall within a ±0.8% error band from the straight line between 0 VDC and 5.0 VDC over the compensated temperature range of -7° to 93°C.

** The output will not vary by more than ±0.8% from the straight line from 0 VDC and 5.0 VDC and shall include the effect of non-linearity, hysteresis, repeatability, regulation, and end points.

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.4.1 TRANSDUCER, PRESSURE

MANUFACTURER Gould, Inc.
Statham Instruments Div. (34)

PART NUMBER PA4022

PROGRAM..... Mariner Venus/Mercury 1973

CONTRACTING AGENCY..... NASA

PRIME CONTRACTOR..... Jet Propulsion Laboratory

STATUS

QUALIFIED..... Yes

FLOWN..... Yes

LAUNCH VEHICLE.....

AVAILABILITY.....

COST/PROCUREMENT INFORMATION...

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.4.1 TRANSDUCER, PRESSURE

OPERATING PRINCIPLE	<u>Strain gage</u>	
DESIGN USE	<u>Vacuum deposited thin film strain gage and</u>	
OPERATING PRESSURE RANGE	<u>0-206</u> N/cm ²	<u>amplibridge electronics</u> (<u>0-300</u> PSIA)
OPERATING TEMPERATURE RANGE	<u>+1 to +74</u> °C	(<u>32 to 165</u> °F)
OUTPUT VOLTAGE RANGE	<u>0-3</u> Vdc	
TIME CONSTANT	<u>.001</u> sec	
DEAD VOLUME	<u>8 x 10⁻⁷</u> cm ³	(<u>.05</u> in ³)
THERMAL SENSITIVITY SHIFT	* <u>±</u> _____ % OF FULL SCALE/°C	
THERMAL ZERO SHIFT	* <u>±</u> _____ % OF FULL SCALE/°C	
LINEARITY	<u>±0.5</u> % OF FULL SCALE	
HYSTERESIS	<u><0.2</u> % OF FULL SCALE	
REPEATABILITY	<u><0.1</u> % OF FULL SCALE	
ACCELERATION ERROR	<u><0.1</u> % OF FULL SCALE/G	
VIBRATION ERROR	<u><0.1</u> % OF FULL SCALE/G	
LIFE	<u>Unlimited</u> CYCLES	
SUPPLY VOLTAGE RANGE	<u>+12</u> VOLTS dc	
SUPPLY CURRENT RANGE	<u>.008</u> AMPERES	
INSULATION RESISTANCE	<u>100</u> MΩ @ <u>50</u> Vdc	
OUTPUT IMPEDENCE	<u><100</u> Ohms	
OUTPUT REGULATION	<u>0.1</u> % CHANGE IN OUTPUT OVER THE FULL RANGE OF INPUT VOLTAGE	
PROOF PRESSURE	<u>150% ES</u> N/cm ²	(_____ PSIA)
BURST PRESSURE	_____ N/cm ²	(_____ PSIA)
EXTERNAL LEAKAGE	<u><1x10⁻⁸</u> scc/s OF <u>He</u> @ <u>5171</u> N/cm ²	(<u>7500</u> PSIA)
MATERIALS	<u>17-4 PH and 300 stainless steel exposed to</u>	
MOUNTING PROVISIONS	<u>pressure media</u> <u>provided by user</u>	
CONNECTIONS -		
ELECTRICAL	<u>Mates with MS3116-10-6S</u>	
PRESSURE	<u>9/16 - 18 stainless steel tube</u>	
MASS	<u>.1</u> kg	(<u>.4</u> lbm)
OTHER SIGNIFICANT CHARACTERISTICS ...		

*The output voltage at 0°C and +74°C shall be within ± 1% FS output of the corresponding value at 25°C and shall repeat within ± 0.2% after a 288 hour soak at 94°C.

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.4.1 TRANSDUCER, PRESSURE

MANUFACTURER Gould Inc.
Statham Instruments Div. (34)

PART NUMBER PA4062

PROGRAM..... FLT-SAT-COM

CONTRACTING AGENCY..... TRW Systems Group

PRIME CONTRACTOR..... USAF

STATUS

QUALIFIED..... Yes

FLOWN.....

LAUNCH VEHICLE.....

AVAILABILITY.....

COST/PROCUREMENT INFORMATION...

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.4.1 TRANSDUCER, PRESSURE

OPERATING PRINCIPLE	<u>Strain gage</u>			
DESIGN USE	<u>Vacuum deposited thin film & amplibridge electronics</u>			
OPERATING PRESSURE RANGE	<u>275</u> N/cm ²	(	<u>400</u> PSIA)
OPERATING TEMPERATURE RANGE	<u>4 to 50</u> °C	(	<u>4 to 120</u> °F)
OUTPUT VOLTAGE RANGE	<u>0 - 5</u> Vdc			
TIME CONSTANT	_____ sec			
DEAD VOLUME	<u>6 x 10⁻⁷</u> cm ³	(	<u>.04</u> in ³)
THERMAL SENSITIVITY SHIFT	* <u>±</u> _____ % OF FULL SCALE/°C			
THERMAL ZERO SHIFT	* <u>±</u> _____ % OF FULL SCALE/°C			
LINEARITY	** <u>±</u> _____ % OF FULL SCALE			
HYSTERESIS	** <u>±</u> _____ % OF FULL SCALE			
REPEATABILITY	** <u>±</u> _____ % OF FULL SCALE			
ACCELERATION ERROR	<u>0.01</u> % OF FULL SCALE/G			
VIBRATION ERROR	<u>0.01</u> % OF FULL SCALE/G			
LIFE	<u>Unlimited</u> CYCLES			
SUPPLY VOLTAGE RANGE	<u>22-32</u> VOLTS dc			
SUPPLY CURRENT RANGE	<u>.010</u> AMPERES	<u>nominal</u>		
INSULATION RESISTANCE	<u>100</u> MΩ @	<u>50</u> Vdc		
OUTPUT IMPEDENCE	<u>150</u> Ohms			
OUTPUT REGULATION	** _____ % CHANGE IN OUTPUT OVER THE FULL RANGE OF INPUT VOLTAGE			
PROOF PRESSURE	<u>413</u> N/cm ²	(	<u>600</u> PSIA)
BURST PRESSURE	<u>3447</u> N/cm ²	(	<u>>5000</u> PSIA)
EXTERNAL LEAKAGE	<u>< 1 x 10⁻⁷</u> scc/s OF _____ @	<u>275</u> N/cm ²	(<u>400</u> PSIA)
MATERIALS	<u>17-4 PH exposed to pressure media</u>			
MOUNTING PROVISIONS	<u>Provided by user</u>			
CONNECTIONS -				
ELECTRICAL	<u>Mates with NAS 1655-10 plug</u>			
PRESSURE	<u>MS33656-E4</u>			
MASS	<u>.16</u> kg	(	<u>.36</u> lbm)

OTHER SIGNIFICANT CHARACTERISTICS ...

*Output shall fall within a 1.8% error band from the straight line between 0 VDC and 5.0 VDC over the compensated temperature range from 4°C to 50°C

**The output will not vary by more than ± 0.8% from the straight line between 0 VDC and 5.0 VDC and shall include the effects of non-linearity, hysteresis, repeatability, regulation, and end points.

4.4.1-10

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.4.1 TRANSDUCER, PRESSURE

MANUFACTURER Rosemount, Inc. (49)

PART NUMBER 1332

PROGRAM..... Celesco Glide Bomb

CONTRACTING AGENCY.....

PRIME CONTRACTOR..... Celesco

STATUS

QUALIFIED..... yes

FLOWN..... yes

LAUNCH VEHICLE.....

AVAILABILITY.....

COST/PROCUREMENT INFORMATION...

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.4.1 TRANSDUCER, PRESSURE

OPERATING PRINCIPLE	<u>Capacitive</u>	
DESIGN USE	<u>Pressure measurement</u>	
OPERATING PRESSURE RANGE	<u>3-344</u> N/cm ²	(<u>5-500</u> PSIA)
OPERATING TEMPERATURE RANGE	<u>-53 to 93.3</u> °C	Compensated over 0 to 150° F (<u>-65 to +200</u> °F)
OUTPUT VOLTAGE RANGE	<u>0-5</u> Vdc	
TIME CONSTANT	<u>5</u> sec	
DEAD VOLUME	<u>1.6</u> cm ³	(<u>0.1</u> in ³)
THERMAL SENSITIVITY SHIFT	<u>±</u> % OF FULL SCALE/°C	
THERMAL ZERO SHIFT	<u>±</u> % OF FULL SCALE/°C	
LINEARITY	<u>± 0.1</u> % OF FULL SCALE	
HYSTERESIS	<u>± 0.4</u> % OF FULL SCALE	
REPEATABILITY	<u>± 0.2</u> % OF FULL SCALE	
ACCELERATION ERROR	<u>0.02</u> % OF FULL SCALE/G	or .005 psi whichever is greater
VIBRATION ERROR	<u>0.04</u> % OF FULL SCALE/G	
LIFE	<u>>100,000</u> CYCLES	
SUPPLY VOLTAGE RANGE	<u>22-32</u> VOLTS dc	
SUPPLY CURRENT RANGE	<u>21</u> AMPERES max	
INSULATION RESISTANCE	<u>100</u> MΩ @ <u>100</u> Vdc	
OUTPUT IMPEDENCE	<u>10</u> Ohms	
OUTPUT REGULATION	<u>0.1</u> % CHANGE IN OUTPUT OVER THE FULL RANGE OF INPUT VOLTAGE	
PROOF PRESSURE	<u> </u> N/cm ²	(<u> </u> PSIA)
BURST PRESSURE	<u>551</u> N/cm ²	(<u>800</u> PSIA)
EXTERNAL LEAKAGE	<u>1 x 10⁻⁷</u> scc/s OF <u>He</u> @ <u>10</u> N/cm ²	(<u>15</u> PSIA)
MATERIALS	<u>304 SS & N. Span C</u>	
MOUNTING PROVISIONS	<u>By pressure fitting or strapped down</u>	
CONNECTIONS -		
ELECTRICAL	<u>Mates with PT06-10-65 mating plug</u>	
PRESSURE	<u>MS33656-4</u>	
MASS	<u>0.2</u> kg	(<u>.4375</u> lbm)
OTHER SIGNIFICANT CHARACTERISTICS ...		

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.4.1 TRANSDUCER, PRESSURE

MANUFACTURER Gould, Inc.
Statham Instruments Div. (34)

PART NUMBER PA 4064

PROGRAM..... Defense Satellite Communications System (DSCS)

CONTRACTING AGENCY..... TRW Systems

PRIME CONTRACTOR..... USAF

STATUS

QUALIFIED..... Yes

FLOWN..... Yes, DSCS 1 and 2

LAUNCH VEHICLE..... Titan 3C

AVAILABILITY..... _____

COST/PROCUREMENT INFORMATION... _____

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.4.1 TRANSDUCER, PRESSURE

OPERATING PRINCIPLE	<u>Strain gage</u>	
DESIGN USE	<u>Vacuum deposited thin film & amplibridge electronics</u>	
OPERATING PRESSURE RANGE	<u>413</u> N/cm ²	(<u>600</u> PSIA)
OPERATING TEMPERATURE RANGE	<u>4 to 50</u> °C	(<u>40 to 120</u> °F)
OUTPUT VOLTAGE RANGE	<u>5</u> Vdc	
TIME CONSTANT	<u>.001</u> sec	
DEAD VOLUME	<u>6 x 10⁻⁷</u> cm ³	(<u>.04</u> in ³)
THERMAL SENSITIVITY SHIFT	* <u>±</u> _____ % OF FULL SCALE/°C	
THERMAL ZERO SHIFT	* <u>±</u> _____ % OF FULL SCALE/°C	
LINEARITY	** <u>±</u> _____ % OF FULL SCALE	
HYSTERESIS	** <u>±</u> _____ % OF FULL SCALE	
REPEATABILITY	** <u>±</u> _____ % OF FULL SCALE	
ACCELERATION ERROR	<u>.01</u> % OF FULL SCALE/G	
VIBRATION ERROR	<u>.01</u> % OF FULL SCALE/G	
LIFE	<u>Unlimited</u> CYCLES	
SUPPLY VOLTAGE RANGE	<u>22-32</u> VOLTS dc	
SUPPLY CURRENT RANGE	<u>.010</u> AMPERES	
INSULATION RESISTANCE	<u>100</u> MΩ @ <u>50</u> Vdc	
OUTPUT IMPEDENCE	<u>150</u> Ohms	
OUTPUT REGULATION	** _____ % CHANGE IN OUTPUT OVER THE FULL RANGE OF INPUT VOLTAGE	
PROOF PRESSURE	<u>620</u> N/cm ²	(<u>900</u> PSIA)
BURST PRESSURE	<u>3447</u> N/cm ²	(<u>5000</u> PSIA)
EXTERNAL LEAKAGE	<u>1 x 10⁻⁷</u> scc/s OF <u>He</u> @ _____ N/cm ² (<u>600</u> PSIA)	
MATERIALS	<u>17-4 PH exposed to pressure media</u>	
MOUNTING PROVISIONS	<u>provided by user.</u>	
CONNECTIONS -		
ELECTRICAL	<u>mates with NAS1655-10 plug</u>	
PRESSURE	<u>MS33656-E4</u>	
MASS	<u>.16</u> kg	(<u>.36</u> lbm)

OTHER SIGNIFICANT CHARACTERISTICS ...

*Output shall fall within a $\pm 1.8\%$ error band from the straight line between 0 VDC and 5.0 VDC over the compensated temp. range of 4°C to 50°C.

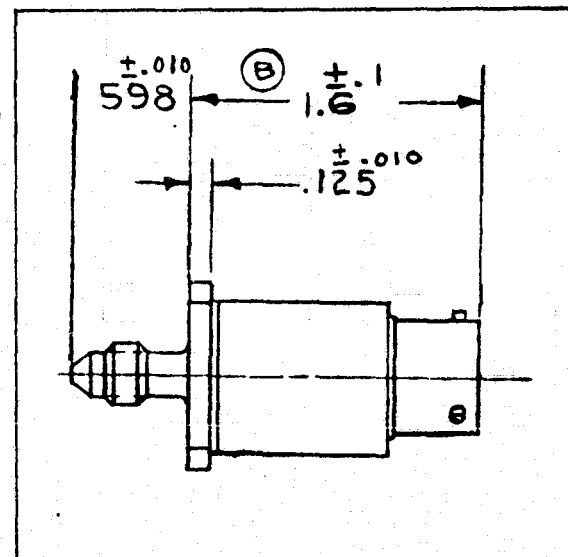
**The output will not vary by more than $\pm 0.8\%$ from the straight line between 0VDC and 5.0 VDC and shall include the effect of non-linearity, hysteresis, repeatability, regulation, and end points.

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.4.1 TRANSDUCER, PRESSURE

MANUFACTURER Gould, Inc.
Statham Instruments Div. (34)

PART NUMBER S53 Thin Film Amplibridge
Pressure Transducing System



PROGRAM..... Spartan

CONTRACTING AGENCY..... McDonnell Douglas Corp.

PRIME CONTRACTOR..... USAF

STATUS

QUALIFIED..... Yes

FLOWN.....

LAUNCH VEHICLE..... Spartan

AVAILABILITY.....

COST/PROCUREMENT INFORMATION...

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.4.1 TRANSDUCER, PRESSURE

OPERATING PRINCIPLE	<u>Strain gage</u>	
DESIGN USE	<u>Vacuum deposited thin film with remote</u>	
OPERATING PRESSURE RANGE	<u>0-1378,2068, 3447</u> N/cm ²	<u>amplibridge electronics</u> (<u>0-2000,3000, 5000</u> PSIA)
OPERATING TEMPERATURE RANGE	<u>+15to+176</u> °C	(<u>+60 to +350</u> °F)
OUTPUT VOLTAGE RANGE	<u>0-5</u> Vdc	
TIME CONSTANT	<u>.001</u> sec	
DEAD VOLUME	<u>3 x 10⁻⁷</u> cm ³	(<u>.02</u> in ³)
THERMAL SENSITIVITY SHIFT	* <u>±</u> % OF FULL SCALE/°C	
THERMAL ZERO SHIFT	* <u>±</u> % OF FULL SCALE/°C	
LINEARITY	<u>± .5</u> % OF FULL SCALE	
HYSTERESIS	<u>±</u> % OF FULL SCALE	
REPEATABILITY	<u>± 0.3</u> % OF FULL SCALE	
ACCELERATION ERROR	<u>.01</u> % OF FULL SCALE/G	
VIBRATION ERROR	<u>.01</u> % OF FULL SCALE/G	
LIFE	<u>Unlimited</u> CYCLES	
SUPPLY VOLTAGE RANGE	<u>25-31</u> VOLTS dc	
SUPPLY CURRENT RANGE	<u>.020</u> AMPERES	
INSULATION RESISTANCE	<u>100</u> MΩ @ <u>50</u> Vdc	
OUTPUT IMPEDENCE	<u>150</u> Ohms	
OUTPUT REGULATION	<u>.05</u> % CHANGE IN OUTPUT OVER THE FULL RANGE OF INPUT VOLTAGE	
PROOF PRESSURE	<u>8273</u> N/cm ²	(<u>12,000</u> PSIA)
BURST PRESSURE	<u>1 x 10⁻⁸</u> scc/s OF <u>HC</u> @ <u>FS</u> N/cm ²	(<u>FS</u> PSIA)
EXTERNAL LEAKAGE		
MATERIALS	<u>17-4 PH stainless steel exposed to pressure media</u>	
MOUNTING PROVISIONS		
CONNECTIONS -		
ELECTRICAL	<u>1130052 receptacle</u>	
PRESSURE	<u>7/16-20 external per MS33656E4</u>	
MASS	<u>.2</u> kg	(<u>.6</u> lbm)

OTHER SIGNIFICANT CHARACTERISTICS ...

*Combined errors will not exceed + 3.5% from a straight line between 0 VDC and 5.0 VDC with the pressure sensor operating at temperature up to 350°F and the amplifier temperature up to 150°F.

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.4.2 TRANSDUCER, TEMPERATURE

MANUFACTURER Rosemount, Inc. (49)

PART NUMBER 171 Series

PROGRAM..... Oceanic Applications - Nat'l Data Barge

CONTRACTING AGENCY.....

PRIME CONTRACTOR.....

STATUS

QUALIFIED..... Yes

FLOWN.....

LAUNCH VEHICLE.....

AVAILABILITY..... 60 days ARO

COST/PROCUREMENT INFORMATION... 1 to 2 units - \$315-\$365 depending
on style and no. of elements

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.4.2 TRANSDUCER, TEMPERATURE

TYPE Pressure insensitive temperature sensor

DESIGN USE Precision ocean temperature measurement

TEMPERATURE MEASUREMENT RANGE -2 to +35°C (+28 to 95°F)

SENSITIVITY ± _____ °C (± _____ °F)

ERROR BAND 0.02 °C (32 °F)

THERMAL TIME CONSTANT _____ sec

SUPPLY VOLTAGE RANGE _____ Vdc

NOMINAL RESISTANCE * _____ Ω @ _____ °C (_____ °F)

MAXIMUM CONTINUOUS CURRENT _____ AMPERES

DIELECTRIC STRENGTH _____ mA MAXIMUM CURRENT LEAKAGE
@ _____ VOLTS rms, Hz

INSULATION RESISTANCE 10 MΩ @ 100 Vdc

MOUNTING PROVISIONS Ceramic insulation in a strain free manner

MATERIAL Platinum wire

CONNECTION-ELECTRICAL _____

MASS _____ kg _____ lbm

OTHER SIGNIFICANT CHARACTERISTICS... *

RESISTANCE-TEMPERATURE RELATIONSHIP

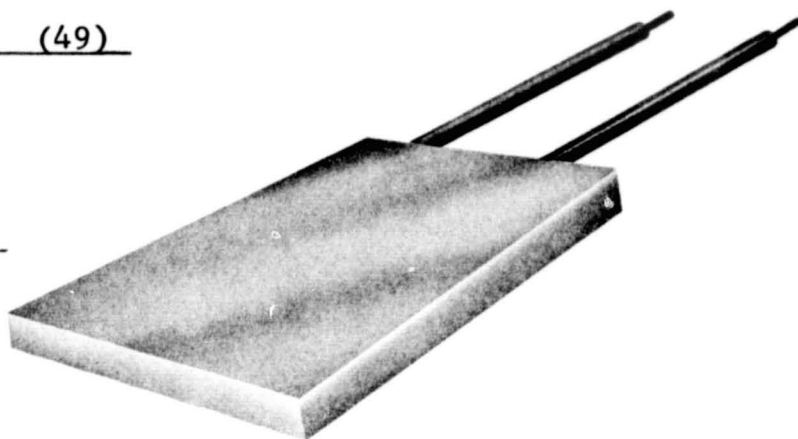
Temperature °C	Resistance (Ohms)	Interchangeability (±Ω)	(±°C)
-2	91.91	0.2	0.54
0	92.65	0.2	0.54
5	94.49	0.2	0.54
10	96.33	0.2	0.54
15	98.17	0.2	0.54
20	100.00	0.2	0.55
25	101.83	0.2	0.55
30	103.66	0.2	0.55
35	105.48	0.2	0.55

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.4.2 TRANSDUCER, TEMPERATURE

MANUFACTURER Rosemount, Inc. (49)

PART NUMBER 118ME



PROGRAM..... Apollo

CONTRACTING AGENCY.....

PRIME CONTRACTOR.....

STATUS

QUALIFIED..... Yes

FLOWN.....

LAUNCH VEHICLE.....

AVAILABILITY..... Standard models in stock. Non-standard model 12 weeks ARO

COST/PROCUREMENT INFORMATION... 1 to 2 units - \$149

4.4.2 TRANSDUCER, TEMPERATURE

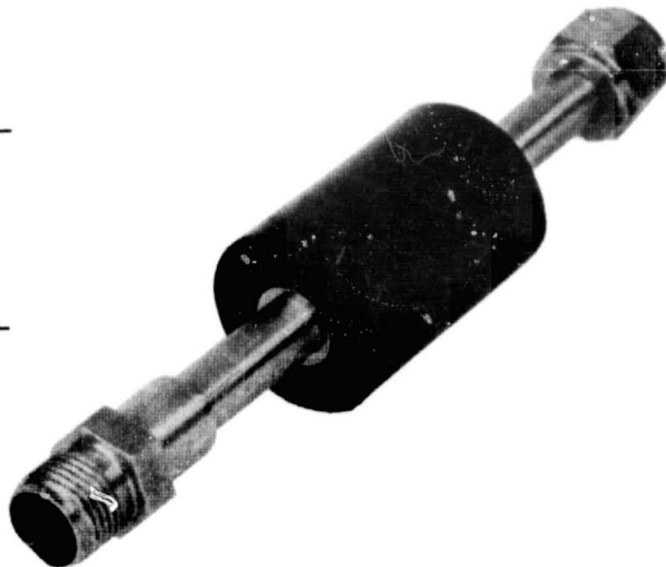
4.4.2-4

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.4.2 TRANSDUCER, TEMPERATURE

MANUFACTURER Rosemount, Inc. (49)

PART NUMBER 110MA



PROGRAM..... Skylab

CONTRACTING AGENCY.....

PRIME CONTRACTOR.....

STATUS

QUALIFIED..... Yes

FLOWN.....

LAUNCH VEHICLE..... Saturn

AVAILABILITY..... 6 to 10 weeks ARO

COST/PROCUREMENT INFORMATION... 1-2 units - \$300

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.4.2 TRANSDUCER, TEMPERATURE

TYPE Platinum resistance temperature sensor

DESIGN USE Measure fluid temperature inside small lines

TEMPERATURE MEASUREMENT RANGE -100 to +220 °C (-148 to 428 °F)

SENSITIVITY ± °C (± °F)

ERROR BAND 0.04 °C (32 °F)

THERMAL TIME CONSTANT 2 sec

SUPPLY VOLTAGE RANGE Vdc

NOMINAL RESISTANCE * Ω @ °C (°F)

MAXIMUM CONTINUOUS CURRENT AMPERES

DIELECTRIC STRENGTH mA MAXIMUM CURRENT LEAKAGE
@ VOLTS rms, Hz

INSULATION RESISTANCE 10 MΩ @ 100 Vdc

MOUNTING PROVISIONS

MATERIAL Stainless steel and a silver brazing alloy

CONNECTION-ELECTRICAL

MASS kg lbm

OTHER SIGNIFICANT CHARACTERISTICS...

RESISTANCE-TEMPERATURE RELATIONSHIP

* * Denotes physical calibration point, interchangeable to ±0.50 ohms (±1.25°C).

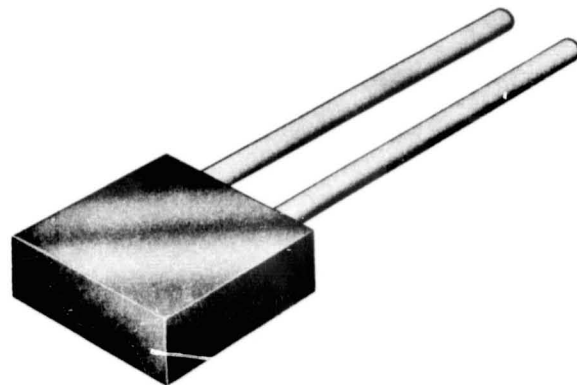
TEMPERATURE (°C)	RESISTANCE (OHMS)
-100.00	59.72
- 80.00	67.91
- 60.00	76.02
- 40.00	84.07
- 20.00	92.06
0.00*	100.00*
20.00	107.88
40.00	115.72
60.00	123.50
80.00	131.24
100.00	138.94
140.00	154.18
180.00	169.24
220.00	184.11

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.4.2 TRANSDUCER, TEMPERATURE

MANUFACTURER Rosemount, Inc. (49)

PART NUMBER 118MA



PROGRAM.....

CONTRACTING AGENCY.....

PRIME CONTRACTOR.....

STATUS

QUALIFIED..... Yes

FLOWN.....

LAUNCH VEHICLE.....

AVAILABILITY..... 6 to 8 weeks ARO

COST/PROCUREMENT INFORMATION... 1 to 2 units - \$112

4.4.2 TRANSDUCER, TEMPERATURE

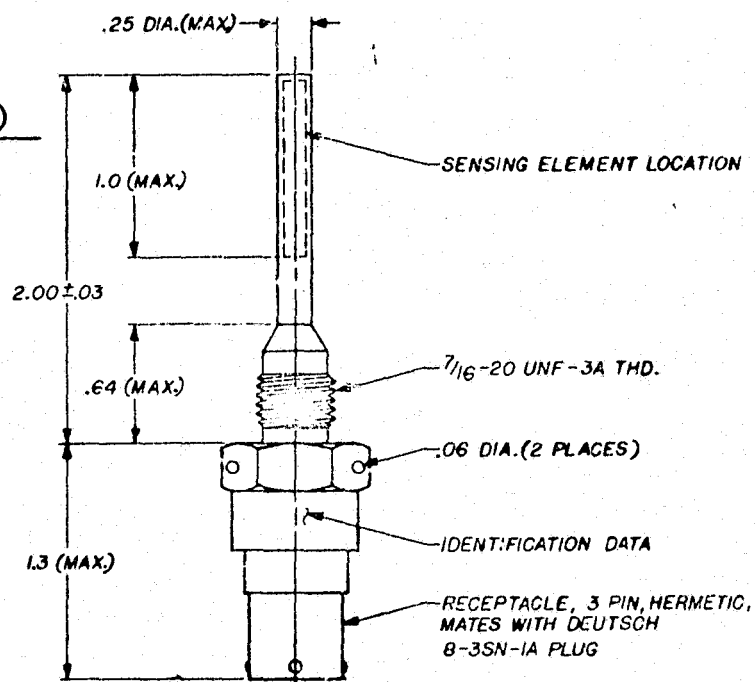
4.4.2-8

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.4.2 TRANSDUCER, TEMPERATURE

MANUFACTURER Rosemount, Inc. (49)

PART NUMBER 137MA



PROGRAM..... L10-11 Aircraft

CONTRACTING AGENCY.....

PRIME CONTRACTOR.....

STATUS

QUALIFIED..... Yes

FLOWN.....

LAUNCH VEHICLE.....

AVAILABILITY..... 4 weeks ARO for small quantities

COST/PROCUREMENT INFORMATION... 1 to 2 units - \$110

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.4.2 TRANSDUCER, TEMPERATURE

TYPE Platinum resistance temperature sensor

DESIGN USE

TEMPERATURE MEASUREMENT RANGE -20 to 320 °C (-4 to 608 °F)

SENSITIVITY ± 0.04 °C (± 36 °F)

ERROR BAND °C (°F)

THERMAL TIME CONSTANT 3.0 sec

SUPPLY VOLTAGE RANGE Vdc

NOMINAL RESISTANCE * Ω @ °C (°F)

MAXIMUM CONTINUOUS CURRENT002 AMPERES

DIELECTRIC STRENGTH mA MAXIMUM CURRENT LEAKAGE
@ VOLTS rms, Hz

INSULATION RESISTANCE 50 MΩ @ 150 Vdc

MOUNTING PROVISIONS

MATERIAL Fully annealed, reference grade platinum wire

CONNECTION-ELECTRICAL

MASS45 kg 1.0 lbm shipping weight

OTHER SIGNIFICANT CHARACTERISTICS...

*

Resistance-Temperature (°C) Relationship

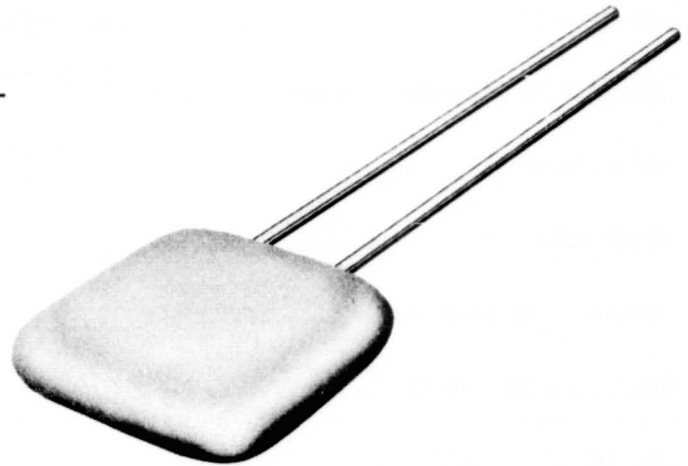
Temp (°C)	Resistance (Ohms)	Interchangeability (± Ohms)	(± °C)
-20	92.00	.55	1.35
0	100.00	.50	1.25
50	119.81	.70	1.60
100	135.33	.95	2.50
150	158.55	1.25	3.25
200	177.48	1.50	4.00
250	196.12	1.75	4.95
300	214.47	2.00	5.50
320	221.72	2.25	6.00

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.4.2 TRANSDUCER, TEMPERATURE

MANUFACTURER Rosemount, Inc. (49)

PART NUMBER 118MF



PROGRAM.....

CONTRACTING AGENCY.....

PRIME CONTRACTOR.....

STATUS

QUALIFIED..... Yes

FLOWN.....

LAUNCH VEHICLE.....

AVAILABILITY..... Standard models in stock.
Non-standard models delivery 2 to 4 weeks ARO

COST/PROCUREMENT INFORMATION... 1 to 2 units - \$85

4.4.2 TRANSDUCER, TEMPERATURE

4.4.2-12

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.4.2 TRANSDUCER, TEMPERATURE

MANUFACTURER Tayco Engineering, Inc. (55)

PART NUMBER 2-2518

PROGRAM..... FLT-SAT-COM

CONTRACTING AGENCY..... TRW Systems

PRIME CONTRACTOR..... _____

STATUS

QUALIFIED..... Yes

FLOWN..... _____

LAUNCH VEHICLE..... _____

AVAILABILITY..... 8 weeks ARO

COST/PROCUREMENT INFORMATION... 5 to 10 units \$371 each

ATTITUDE CONTROL PROPULSION COMPONENT DATA SHEET

4.4.2 TRANSDUCER, TEMPERATURE

TYPE Platinum probe, with platinum sheathing
 DESIGN USE Catalyst Bed
 TEMPERATURE MEASUREMENT RANGE -100 to +1000 °C (0 to 1800 °F)
 SENSITIVITY ± .1 °C (± °F)
 ERROR BAND25% °C (°F)
 THERMAL TIME CONSTANT 2 sec
 SUPPLY VOLTAGE RANGE 0-5 Vdc
 NOMINAL RESISTANCE 100 Ω @ 0 °C (32 °F)
 MAXIMUM CONTINUOUS CURRENT020 AMPERES
 DIELECTRIC STRENGTH 5 mA MAXIMUM CURRENT LEAKAGE
 @ 500 VOLTS rms, Hz
 INSULATION RESISTANCE 10 MΩ @ 100 Vdc
 MOUNTING PROVISIONS Probe and weld on strap
 MATERIAL Platinum
 CONNECTION-ELECTRICAL Pigtail
 MASS kg lbm
 OTHER SIGNIFICANT CHARACTERISTICS... Capable of repeated thermal shocks to 982°C (1800°F)
upon firing of Thrust Chambers

5.1 COMPONENT-ORDERED DATA SUMMARY

COMPONENT	MANUFACTURER	PART NO.	PROGRAM	DATA SHEET NO.
FILTER, GAS	AIRCRAFT POROUS MEDIA	AC6875853	APOLLO	4.2.1-1
FILTER, GAS	AIRCRAFT POROUS MEDIA	AC6875855	APOLLO	4.2.1-13
FILTER, GAS	BRUNSWICK	11204-501	APOLLO	4.2.1-23
FILTER, GAS	BRUNSWICK	12204-505	APOLLO	4.2.1-25
FILTER, GAS	BRUNSWICK	12204-508	APOLLO	4.2.1-21
FILTER, GAS	BRUNSWICK	14228-502	USAF	4.2.1-17
FILTER, GAS	BRUNSWICK	15204-516	APOLLO	4.2.1-27
FILTER, GAS	BRUNSWICK	3228-506	CLASSIFIED	4.2.1-15
FILTER, GAS	VACCO	F1D010178-01	--	4.2.1-7
FILTER, GAS	VACCO	F1D10132-01	APOLLO	4.2.1-19
FILTER, GAS	VACCO	F1D10180-01	OSO-1	4.2.1-3
FILTER, GAS	VACCO	SL-81019	LUNAR ORBITER	4.2.1-5
FILTER, GAS	VACCO	SL-81500	APOLLO	4.2.1-9
FILTER, GAS	VACCO	S2-8846	LEM	4.2.1-11
FILTER, LIQUID	BRUNSWICK	15228-572	VIKING	4.2.2-27
FILTER, LIQUID	BRUNSWICK	15241-525	APOLLO	4.2.2-15
FILTER, LIQUID	BRUNSWICK	15241-526	APOLLO	4.2.2-13

5.1 COMPONENT-ORDERED DATA SUMMARY

COMPONENT -----	MANUFACTURER -----	PART NO. -----	PROGRAM -----	DATA SHEET NO. -----
FILTER, LIQUID	BRUNSWICK	15241-647	777	4.2.2-9
FILTER, LIQUID	BRUNSWICK	15312-501-1	P95 SATELLITE	4.2.2-17
FILTER, LIQUID	BRUNSWICK	15312-501-3	P95 SATILLITE	4.2.2-19
FILTER, LIQUID	VACCO	E-89196-4-15	TITAN III	4.2.2-11
FILTER, LIQUID	VACCO	F1D10064-01	COMSAT INTELSAT IV	4.2.2-1
FILTER, LIQUID	VACCO	F1D10093-01,- 02	MARINER AND VIKING	4.2.2-25
FILTER, LIQUID	VACCO	F1D10106-01	ERTS	4.2.2-21
FILTER, LIQUID	VACCO	F1D10106-02	ERB	4.2.2-23
FILTER, LIQUID	VACCO	F1D10151-01	CANADIAN SATELLITE	4.2.2-5
FILTER, LIQUID	VACCO	F1D10182-01,- 02	CTS	4.2.2-3
FILTER, LIQUID	WINTEC	15241-685	AE	4.2.2-7
REGULATOR, GAS PRESSURE	ALLEN DESIGN	13890	AEROBEE	4.2.6-47
REGULATOR, GAS PRESSURE	CONSOLIDATED CONTROLS	6890	MINUTEMEN 111	4.2.6-27
REGULATOR, GAS PRESSURE	CONSOLIDATED CONTROLS	6894	MARINER 71, VIKING ORBITER 75	4.2.6-33
REGULATOR, GAS PRESSURE	FAIRCHILD	332000	MIMUTEMEN 111	4.2.6-29

5.1-2

5.1 COMPONENT-ORDERED DATA SUMMARY

COMPONENT -----	MANUFACTURER -----	PART NO. -----	PROGRAM -----	DATA SHEET NO. -----
REGULATOR, GAS PRESSURE	FAIRCHILD	385000	LM	4.2.6-19
REGULATOR, GAS PRESSURE	FAIRCHILD	601000	QAO	4.2.6-1
REGULATOR, GAS PRESSURE	FAIRCHILD	617000	QAO	4.2.6-11
REGULATOR, GAS PRESSURE	FAIRCHILD	63-036	APOLLO COMMAND MOD RCS,LMRCS	4.2.6-21
REGULATOR, GAS PRESSURE	FAIRCHILD	65-168	SATURN 1V-B	4.2.6-23
REGULATOR, GAS PRESSURE	FAIRCHILD	679000	SATURN 1VB & S-1VB	4.2.6-41
REGULATOR, GAS PRESSURE	HTL INDUSTRIES	146650-10	CENTAUR	4.2.6-37
REGULATOR, GAS PRESSURE	HTL INDUSTRIES	146650-11	CENTAUR	4.2.6-39
REGULATOR, GAS PRESSURE	MAROTTA	226154	APOLLO	4.2.6-9
REGULATOR, GAS PRESSURE	MAROTTA	280601	--	4.2.6-31
REGULATOR, GAS PRESSURE	MAROTTA	280778	--	4.2.6-43
REGULATOR, GAS PRESSURE	STERER	25210-1	MARINER MARS '71	4.2.6-5
REGULATOR, GAS PRESSURE	STERER	33120-1	ERTS	4.2.6-15
REGULATOR, GAS PRESSURE	STERER	34810	--	4.2.6-13
REGULATOR, GAS PRESSURE	STERER	46240	VO'75	4.2.6-7
REGULATOR, GAS PRESSURE	TAVCO	2344344	--	4.2.6-17
REGULATOR, GAS PRESSURE	TAVCO	2346334	--	4.2.6-45

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5.1-3

5.1 COMPONENT-ORDERED DATA SUMMARY

COMPONENT -----	MANUFACTURER -----	PART NO. -----	PROGRAM -----	DATA SHEET NO. -----
REGULATOR, GAS PRESSURE	TAVCO	2346340	--	4.2.6-3
REGULATOR, GAS PRESSURE	TAVCO	234635	--	4.2.6-25
REGULATOR, GAS PRESSURE	TRW SYSTEMS	JPL 10000055	MARINER '69	4.2.6-35
REGULATOR, GAS PRESSURE	WHITTAKER	123035	--	4.2.6-49
THRUSTER, HYDRAZINE	BELL AEROSPACE	8760	LOW COAST STAND. SPACE EQUIP.	4.3.1-9
THRUSTER, HYDRAZINE	HAMILTON STANDARD	SV 748525	CTS	4.3.1-17
THRUSTER, HYDRAZINE	HAMILTON STANDARD	SV 748563	CLASSIFIED	4.3.1-101
THRUSTER, HYDRAZINE	HAMILTON STANDARD	SV 755446	NATO 111	4.3.1-57
THRUSTER, HYDRAZINE	HAMILTON STANDARD	SV748562	CLASSIFIED	4.3.1-31
THRUSTER, HYDRAZINE	HAMILTON STANDARD	SV755436	MSD	4.3.1-61
THRUSTER, HYDRAZINE	HAMILTON STANDARD	SV755437	MSD	4.3.1-21
THRUSTER, HYDRAZINE	HAMILTON STANDARD	SV755458-1	TIP-II	4.3.1-72
THRUSTER, HYDRAZINE	HUGHES AIRCRAFT	3194300	INTELSAT IV	4.3.1-53
THRUSTER, HYDRAZINE	HUGHES AIRCRAFT	3251415-101	ANIK, WESTAR, MARISAT	4.3.1-27
THRUSTER, HYDRAZINE	HUGHES AIRCRAFT	328F410-100	--	4.3.1-67
THRUSTER, HYDRAZINE	HUGHES AIRCRAFT	3354474	INTELSAT IVA	4.3.1-49

5.1 COMPONENT-ORDERED DATA SUMMARY

COMPONENT -----	MANUFACTURER -----	PART NO. -----	PROGRAM -----	DATA SHEET NO. -----
THRUSTER, HYDRAZINE	ROCKET RESEARCH	MR-50A	P-95, BLOCK 1	4.3.1-79
THRUSTER, HYDRAZINE	ROCKET RESEARCH	MR-50E	SMS, METEOSAT	4.3.1-91
THRUSTER, HYDRAZINE	ROCKET RESEARCH	MR-50F	VIKING RCS REA	4.3.1-83
THRUSTER, HYDRAZINE	ROCKET RESEARCH	MR-6C	SMS, METEOSAT	4.3.1-39
THRUSTER, HYDRAZINE	ROCKET RESEARCH	MR-74A	ATS F&G	4.3.1-1
THRUSTER, HYDRAZINE	ROCKET RESERCH	MR-50H	P-95, BLOCK III	4.3.1-75
THRUSTER, HYDRAZINE	TRW SYSTEMS	MRE-0,1	FLTSATCOM	4.3.1-13
THRUSTER, HYDRAZINE	TRW SYSTEMS	MRE-4-A-1	INTELSAT 111	4.3.1-43
THRUSTER, HYDRAZINE	TRW SYSTEMS	410618	PIONEER 10&11, FLTSATCOM	4.3.1-35
TRANSDUCER, PRESSURE	BOURNS	2023090400	--	4.4.1-1
TRANSDUCER, PRESSURE	GOULD	PA 4064	DSCS	4.4.1-13
TRANSDUCER, PRESSURE	GOULD	PA4022	MVM'73	4.4.1-7
TRANSDUCER, PRESSURE	GOULD	PA4062	FLTSATCOM	4.4.1-9
TRANSDUCER, PRESSURE	GOULD	PA493	DELTA	4.4.1-5
TRANSDUCER, PRESSURE	GOULD	PA850-150- 17575	MINUTEMAN III, PSRE	4.4.1-3
TRANSDUCER, PRESSURE	GOULD	S53	SPARTAN	4.4.1-15

5.1 COMPONENT-ORDERED DATA SUMMARY

COMPONENT -----	MANUFACTURER -----	PART NO. -----	PROGRAM -----	DATA SHEET NO. -----
TRANSDUCER, PRESSURE	ROSEMOUNT	1332	CELESCO GLIDE BOMB	4.4.1-11
TRANSDUCER, TEMPERATURE	ROSEMOUNT	110MA	SKYLAB	4.4.2-5
TRANSDUCER, TEMPERATURE	ROSEMOUNT	118MA	--	4.4.2-7
TRANSDUCER, TEMPERATURE	ROSEMOUNT	118ME	APOLLO	4.4.2-3
TRANSDUCER, TEMPERATURE	ROSEMOUNT	118MF	--	4.4.2-11
TRANSDUCER, TEMPERATURE	ROSEMOUNT	137MA	L10-11 AIRCRAFT	4.4.2-9
TRANSDUCER, TEMPERATURE	ROSEMOUNT	171 SERIES	OCEANIC APPL	4.4.2-1
TRANSDUCER, TEMPERATURE	TAYCO	2-2518	FLT-SAT-COM	4.4.2-13
VALVE, CHECK	HTL INDUSTRIES	155340-4	SE-5	4.2.5-1
VALVE, CHECK	HTL INDUSTRIES	212870-2	MARINER 69(M2)	4.2.5-9
VALVE, CHECK	HTL INDUSTRIES	255360-3	VIKING ORBITER '75	4.2.5-3
VALVE, CHECK	HTL INDUSTRIES	255510-2	MARINER 71	4.2.5-11
VALVE, CHECK	MAROTTA	801602	--	4.2.5-7
VALVE, CHECK	TAVCO	232129	--	4.2.5-13
VALVE, CHECK	TAVCO	2324212	--	4.2.5-5
VALVE, COLD GAS JET	ALLEN DESIGN	13422	DELTA	4.3.3-11
VALVE, COLD GAS JET	ALLEN DESIGN	13515	AEROBEE	4.3.3-9

5.1 COMPONENT-ORDERED DATA SUMMARY

COMPONENT -----	MANUFACTURER -----	PART NO. -----	PROGRAM -----	DATA SHEET NO. -----
VALVE, COLD GAS JET	ALLEN DESIGN	13535	AEROBEE	4.3.3-37
VALVE, COLD GAS JET	ALLEN DESIGN	13705	AEROBEE	4.3.3-19
VALVE, COLD GAS JET	ALLEN DESIGN	13854	AEROBEE	4.3.3-21
VALVE, COLD GAS JET	ALLEN DESIGN	13880	AEROBEE	4.3.3-5
VALVE, COLD GAS JET	ALLEN DESIGN	13903	--	4.3.3-25
VALVE, COLD GAS JET	COLT INDUSTRIES	CRTC-6	STRYTI	4.3.3-49
VALVE, COLD GAS JET	COLT INDUSTRIES	CRTC-7	CLASSIFIED	4.3.3-51
VALVE, COLD GAS JET	COLT INDUSTRIES	CRTS-2	SPACS AND HARP	4.3.3-53
VALVE, COLD GAS JET	CONSOLIDATED CONTROLS	72520	DELTA THOR	4.3.3-31
VALVE, COLD GAS JET	FAIRCHILD	683000	0A0	4.3.3-55
VALVE, COLD GAS JET	FUTUREGRAFT	--	CLASSIFIED	4.3.3-57
VALVE, COLD GAS JET	MAROTTA	227174	LORV	4.3.3-35
VALVE, COLD GAS JET	SIEBELAIR	2900-0 THRU-7	AEROBEE, HI STAR, MK III, SCOOP, SUPER CHIEF	4.3.3-7
VALVE, COLD GAS JET	SIEBELAIR	2950-0 & A/R	SUPER CHIEF & NRL SOUNDING ROCKETS	4.3.3-29

5.1 COMPONENT-ORDERED DATA SUMMARY

COMPONENT -----	MANUFACTURER -----	PART NO. -----	PROGRAM -----	DATA SHEET NO. -----
VALVE, COLD GAS JET	STERER	22690	AGENA	4.3.3-41
VALVE, COLD GAS JET	STERER	24050	PROJECT 'FIRE'	4.3.3-27
VALVE, COLD GAS JET	STERER	24060	PROJECT 'FIRE'	4.3.3-33
VALVE, COLD GAS JET	STERER	29830	PROJECT 'PRIME'	4.3.3-15
VALVE, COLD GAS JET	STERER	33130	ERTS	4.3.3-23
VALVE, COLD GAS JET	STERER	34880	PROJECT '169'	4.3.3-13
VALVE, COLD GAS JET	VALCOR	V27200-288	RE-ENTRY, CLASSIFIED	4.3.3-17
VALVE, COLD GAS JET	VALCOR	V27200-510	ELMS	4.3.3-39
VALVE, COLD GAS JET	VALCOR	V67000-02	MOL	4.3.3-1
VALVE, COLD GAS JET	WRIGHT COMPONENTS	15398	ATS D/E	4.3.3-59
VALVE, COLD GAS JET	WRIGHT COMPONENTS	15457	--	4.3.3-61
VALVE, COLD GAS JET	WRIGHT COMPONENTS	15607	IMP I/H & LES 8/9	4.3.3-3
VALVE, COLD GAS JET	WRIGHT COMPONENTS	15609	REA-B	4.3.3-63
VALVE, COLD GAS JET	WRIGHT COMPONENTS	15626	SOLRAD II A & B	4.3.3-43
VALVE, COLD GAS JET	WRIGHT COMPONENTS	15749	SOLRAD X1	
VALVE, COLD GAS JET	WRIGHT COMPONENTS	15750	SOLRAD X 1	4.3.3-47
VALVE, COLD GAS JET	WRIGHT COMPONENTS	15751	ELMS	4.3.3-65

5.1 COMPONENT-ORDERED DATA SUMMARY

COMPONENT -----	MANUFACTURER -----	PART NO. -----	PROGRAM -----	DATA SHEET NO. -----
VALVE, FILL & VENT	CONSOLIDATED CONTROLS	71665	--	4.2.7-13
VALVE, FILL & VENT	CONSOLIDATED CONTROLS	72580	P95	4.2.7-1
VALVE, FILL & VENT	CONSOLIDATED CONTROLS	72855	P-50	4.2.7-3
VALVE, FILL & VENT	ECKEL VALVE	AF56C-293	FAIR II	4.2.7-15
VALVE, FILL & VENT	HTL INDUSTRIES	255620-3	VIKING ORBITER '75	4.2.7-11
VALVE, FILL & VENT	HUGHES AIRCRAFT	325-7167	INTELSAT IV A WESTAR ANIK	4.2.7-5
VALVE, FILL & VENT	PYRONETICS	1146, 1176	APOLLO, ATS, ETC	4.2.7-17
VALVE, FILL & VENT	PYRONETICS	1176-16 & 1832-1	TIP-II	4.2.7-19
VALVE, FILL & VENT	PYRONETICS	1811-4, 1821- 1	N. ROCKET	4.2.7-21
VALVE, FILL & VENT	PYRONETICS	1819	COMSAT, VIKING, ETC	4.2.7-23
VALVE, FILL & VENT	PYRONETICS	1831	VIKING '75	4.2.7-9
VALVE, FILL & VENT	TRW SYSTEMS	409708	AE	4.2.7-25
VALVE, FILL & VENT	WRIGHT COMPONENTS	12183	MSD	4.2.7-7
VALVE, HYDRAZINE THRUSTER	ALLEN DESIGN	13880	AEROJET MFG.	4.3.2-5

5.1 COMPONENT-ORDERED DATA SUMMARY

COMPONENT	MANUFACTURER	PART NO.	PROGRAM	DATA SHEET NO.
VALVE, HYDRAZINE THRUSTER	ALLEN DESIGN	13899	--	4.3.2-7
VALVE, HYDRAZINE THRUSTER	ALLEN DESIGN	13987	--	4.3.2-19
VALVE, HYDRAZINE THRUSTER	ECKEL VALVE	AF56C-279	FAIR II	4.3.2-13
VALVE, HYDRAZINE THRUSTER	FAIRCHILD	EQ2-379	AE	4.3.2-17
VALVE, HYDRAZINE THRUSTER	FAIRCHILD	403000		4.3.2-15
VALVE, HYDRAZINE THRUSTER	HYDRAULIC RESERCH	48002330	TIP-II	4.3.2-23
VALVE, HYDRAZINE THRUSTER	MOOG	20-315AA	TITAN TRANSTAGE	4.3.2-27
VALVE, HYDRAZINE THRUSTER	MOOG	50-399	P-95	4.3.2-11
VALVE, HYDRAZINE THRUSTER	MOOG	50-415	CLASSIFIED	4.3.2-25
VALVE, HYDRAZINE THRUSTER	MOOG	50-441	JAPANESE 'N' LAUNCH VIJICLE	4.3.2-21
VALVE, HYDRAZINE THRUSTER	WRIGHT COMPONENTS	15548	SOLRAD X	4.3.2-3
VALVE, HYDRAZINE THRUSTER	WRIGHT COMPONENTS	15617-14	CTS	4.3.2-1
VALVE, HYDRAZINE THRUSTER	WRIGHT COMPONENTS	15676	SOLRAD X 1	4.3.2-9
VALVE, PROPELLANT ISOLATION	CIRCLE SEAL	V-4339	SPACE SHUTTLE	4.2.3-69
VALVE, PROPELLANT ISOLATION	CIRCLE SEAL	V-4340	SPACE SHUTTLE	4.2.3-77
VALVE, PROPELLANT ISOLATION	CIRCLE SEAL	V-4341	SPACE SHUTTLE	4.2.3-45
VALVE, PROPELLANT ISOLATION	CONSOLIDATED CONTROLS	3490-4	APOLLO	4.2.3-97

5.1-10

5.1 COMPONENT-ORDERED DATA SUMMARY

COMPONENT	MANUFACTURER	PART NO.	PROGRAM	DATA SHEET NO.
VALVE, PROPELLANT ISOLATION	CONSOLIDATED CONTROLS	3490-5	APOLLO	4.2.3-85
VALVE, PROPELLANT ISOLATION	CONSOLIDATED CONTROLS	3795	P-95	4.2.3-73
VALVE, PROPELLANT ISOLATION	CONSOLIDATED CONTROLS	669900	APOLLO	4.2.3-17
VALVE, PROPELLANT ISOLATION	CONSOLIDATED CONTROLS	72513	--	4.2.3-101
VALVE, PROPELLANT ISOLATION	MAROTTA	280096	--	4.2.3-57
VALVE, PROPELLANT ISOLATION	MAROTTA	281022	--	4.2.3-65
VALVE, PROPELLANT ISOLATION	MAROTTA	281233	STINGER	4.2.3-89
VALVE, PROPELLANT ISOLATION	MOOG	50-436	EARTH ATMOSPHERE EXPLORER	4.2.3-33
VALVE, PROPELLANT ISOLATION	PYRONETICS	EQ13-50	AE	4.2.3-37
VALVE, PROPELLANT ISOLATION	VALCOR	V27200-120&-121	NIMBUS&OAO	4.2.3-61
VALVE, PROPELLANT ISOLATION	VALCOR	V27200-195		4.2.3-49
VALVE, PROPELLANT ISOLATION	VALCOR	V27200-320	APS	4.2.3-105
VALVE, PROPELLANT ISOLATION	VALCOR	V27200-339	AEROBEE	4.2.3-41
VALVE, PROPELLANT ISOLATION	VALCOR	V27200-411	CLASSIFIED	4.2.3-53

5.1 COMPONENT-ORDERED DATA SUMMARY

COMPONENT -----	MANUFACTURER -----	PART NO. -----	PROGRAM -----	DATA SHEET NO. -----
VALVE, PROPELLANT ISOLATION	VALCOR	V27200-437	APOLLO	4.2.3-93
VALVE, PROPELLANT ISOLATION	VALCOR	V27200-454	COMSAT	4.2.3-25
VALVE, PROPELLANT ISOLATION	VALCOR	V27200-513	ELMS	4.2.3-29
VALVE, PROPELLANT ISOLATION	VALCOR	V47200-16	LEM	4.2.3-81
VALVE, PROPELLANT ISOLATION	WHITTAKER	137455	AGENA	4.2.3-21
VALVE, PROPELLANT ISOLATION	WRIGHT COMPONENTS	15447	NRL RADIATION EXPERIMENT	4.2.3-1
VALVE, PROPELLANT ISOLATION	WRIGHT COMPONENTS	15512-1	SOLRAD-X	4.2.3-5
VALVE, PROPELLANT ISOLATION	WRIGHT COMPONENTS	15625	LES 8/9, DISCOS, SOLRAD A AND B	4.2.3-9
VALVE, PROPELLANT ISOLATION	WRIGHT COMPONENTS	15675	SOLRAD X1	4.2.3-13
VALVE, RELIEF	AMETEK/CALMEC	1039	MOL RCS	4.2.4-31
VALVE, RELIEF	AMETEK/CALMEC	1049	AAP	4.2.4-33
VALVE, RELIEF	AMETEK/CALMEC	1113	MARINER 71	4.2.4-15
VALVE, RELIEF	AMETEK/CALMEC	615	LUNAR ORBITER	4.2.4-29
VALVE, RELIEF	FAIRCHILD	56-399	X-15	4.2.4-25
VALVE, RELIEF	FAIRCHILD	834000	OWS	4.2.4-3
VALVE, RELIEF	HTL INDUSTRIES	193790-4	SE-5	4.2.4-17

5.1-12

5.1 COMPONENT-ORDERED DATA SUMMARY

COMPONENT	MANUFACTURER	PART NO.	PROGRAM	DATA SHEET NO.
VALVE, RELIEF	HTL INDUSTRIES	230200-2	MARINER 69(M2)	4.2.4-13
VALVE, RELIEF	SIEBELAIR	1488	APOLLO	4.2.4-19
VALVE, RELIEF	STERER	48343	VIKING 175	4.2.4-5
VALVE, RELIEF	TAVCO	2391214	--	4.2.4-1
VALVE, RELIEF	TAVCO	2391237	--	4.2.4-21
VALVE, RELIEF	TAVCO	2391246	--	4.2.4-11
VALVE, RELIEF	TAVCO	2394222	--	4.2.4-27
VALVE, RELIEF	TAVCO	2396245	--	4.2.4-23
VALVE, RELIEF	TAVCO	2396249	--	
VALVE, RELIEF	WHITTAKER	145485(-7)	AGENA DISCOVERER	4.2.4-7

5.1-13

5.2 MANUFACTURER-ORDERED DATA SUMMARY

MANUFACTURER	PART NO.	PRIME CONTRACTOR	COMPONENT	DATA SHEET NO.
AIRCRAFT POROUS MEDIA	AC6875853	--	FILTER, GAS	4.2.1-1
AIRCRAFT POROUS MEDIA	AC6875855	--	FILTER, GAS	4.2.1-13
ALLEN DESIGN	13422	AEROJET	VALVE, COLD GAS JET	4.3.3-11
ALLEN DESIGN	13515	AEROJET	VALVE, COLD GAS JET	4.3.3-9
ALLEN DESIGN	13535	AEROJET	VALVE, COLD GAS JET	4.3.3-37
ALLEN DESIGN	13705	AEROJET	VALVE, COLD GAS JET	4.3.3-19
ALLEN DESIGN	13854	--	VALVE, COLD GAS JET	4.3.3-21
ALLEN DESIGN	13880	--	VALVE, HYDRAZINE THRUSTER	4.3.2-5
ALLEN DESIGN	13880	AEROJET	VALVE, COLD GAS JET	4.3.3-5
ALLEN DESIGN	13890	AEROJET	REGULATOR, GAS PRESSURE	4.2.6-47
ALLEN DESIGN	13899	ROCKET RESEARCH	VALVE, HYDRAZINE THRUSTER	4.3.2-7
ALLEN DESIGN	13903	PHILCO-FORD	VALVE, COLD GAS JET	4.3.3-25
ALLEN DESIGN	13987	ROCKET RESEARCH	VALVE, HYDRAZINE THRUSTER	4.3.2-19
AMETEK/CALMEC	1039	--	VALVE, RELIEF	4.2.4-31
AMETEK/CALMEC	1049	--	VALVE, RELIEF	4.2.4-33
AMETEK/CALMEC	1113	--	VALVE, RELIEF	4.2.4-15
AMETEK/CALMEC	615	--	VALVE, RELIEF	4.2.4-29

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5.2 MANUFACTURER-ORDERED DATA SUMMARY

MANUFACTURER -----	PART NO. -----	PRIME CONTRACTOR -----	COMPONENT -----	DATA SHEET NO. -----
BELL AEROSPACE	8760	BELL AEROSPACE	THRUSTER, HYDRAZINE	4.3.1-9
BOURNS	2023090400	--	TRANSDUCER, PRESSURE	4.4.1-1
BRUNSWICK	11204-501	--	FILTER, GAS	4.2.1-23
BRUNSWICK	12204-505	--	FILTER, GAS	4.2.1-25
BRUNSWICK	12204-508	--	FILTER, GAS	4.2.1-21
BRUNSWICK	14228-502	--	FILTER, GAS	4.2.1-17
BRUNSWICK	15204-516	--	FILTER, GAS	4.2.1-27
BRUNSWICK	15228-572		FILTER, LIQUID	4.2.2-27
BRUNSWICK	15241-525	--	FILTER, LIQUID	4.2.2-15
BRUNSWICK	15241-526	--	FILTER, LIQUID	4.2.2-13
BRUNSWICK	15241-647	--	FILTER, LIQUID	4.2.2-9
BRUNSWICK	15312-501-1	--	FILTER, LIQUID	4.2.2-17
BRUNSWICK	15312-501-3	--	FILTER, LIQUID	4.2.2-19
BRUNSWICK	3228-506	--	FILTER, GAS	4.2.1-15
CIRCLE SEAL	V-4339	ROCKWELL	VALVE, PROPELLANT ISOLATION	4.2.3-69
CIRCLE SEAL	V-4340	ROCKWELL	VALVE, PROPELLANT ISOLATION	4.2.3-77
CIRCLE SEAL	V-4341	ROCKWELL	VALVE, PROPELLANT ISOLATION	4.2.3-45

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5.2 MANUFACTURER-ORDERED DATA SUMMARY

MANUFACTURER -----	PART NO. -----	PRIME CONTRACTOR -----	COMPONENT -----	DATA SHEET NO. -----
COLT INDUSTRIES	CRTC-6	SANDIA	VALVE, COLD GAS JET	4.3.3-49
COLT INDUSTRIES	CRTC-7	SANDIA	VALVE, COLD GAS JET	4.3.3-51
COLT INDUSTRIES	CRTS-2	SANDIA & CANADIAN GOV	VALVE, COLD GAS JET	4.3.3-53
CONSOLIDATED CONTROLS	3490-4	ROCKWELL	VALVE, PROPELLANT ISOLATION	4.2.3-97
CONSOLIDATED CONTROLS	3490-5	ROCKWELL	VALVE, PROPELLANT ISOLATION	4.2.3-85
CONSOLIDATED CONTROLS	3795	LOCKHEED	VALVE, PROPELLANT ISOLATION	4.2.3-73
CONSOLIDATED CONTROLS	669900	ROCKWELL	VALVE, PROPELLANT ISOLATION	4.2.3-17
CONSOLIDATED CONTROLS	6890	ROCKWELL	REGULATOR, GAS PRESSURE	4.2.6-27
CONSOLIDATED CONTROLS	6894	MARTIN MARIETTA	REGULATOR, GAS PRESSURE	4.2.6-33
CONSOLIDATED CONTROLS	71665	LOCKHEED	VALVE, FILL & VENT	4.2.7-13
CONSOLIDATED CONTROLS	72513	LOCKHEED	VALVE, PROPELLANT ISOLATION	4.2.3-101
CONSOLIDATED CONTROLS	72520	MCDONNELL DOUGLAS	VALVE, COLD GAS JET	4.3.3-31

5.2 MANUFACTURER-ORDERED DATA SUMMARY

MANUFACTURER -----	PART NO. -----	PRIME CONTRACTOR -----	COMPONENT -----	DATA SHEET NO. -----
CONSOLIDATED CONTROLS	72580	LOCKHEED	VALVE, FILL & VENT	4.2.7-1
CONSOLIDATED CONTROLS	72855	LOCKHEED	VALVE, FILL & VENT	4.2.7-3
ECKEL VALVE	AF56C-279	PHILCO FORD	VALVE, HYDRAZINE THRUSTER	4.3.2-13
ECKEL VALVE	AF56C-293	PHILCO FORD	VALVE, FILL & VENT	4.2.7-15
FAIRCHILD	EQ2-379	NASA/GSFC	VALVE, HYDRAZINE THRUSTER	4.3.2-17
FAIRCHILD	332000	BELL AEROSPACE	REGULATOR, GAS PRESSURE	4.2.6-29
FAIRCHILD	385000	G.A.C.	REGULATOR, GAS PRESSURE	4.2.6-19
FAIRCHILD	403000	TRW SYSTEMS	VALVE, HYDRAZINE THRUSTER	4.3.2-15
FAIRCHILD	56-399	ROCKWELL	VALVE, RELIEF	4.2.4-25
FAIRCHILD	601000	G.A.C.	REGULATOR, GAS PRESSURE	4.2.6-1
FAIRCHILD	617000	G.A.C.	REGULATOR, GAS PRESSURE	4.2.6-11
FAIRCHILD	63-036	--	REGULATOR, GAS PRESSURE	4.2.6-21
FAIRCHILD	65-168	M.D.C.	REGULATOR, GAS PRESSURE	4.2.6-23
FAIRCHILD	679000	M.D.C.	REGULATOR, GAS PRESSURE	4.2.6-41
FAIRCHILD	683000	GAC	VALVE, COLD GAS JET	4.3.3-55
FAIRCHILD	834000	NASA	VALVE, RELIEF	4.2.4-3

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5.2 MANUFACTURER-ORDERED DATA SUMMARY

MANUFACTURER -----	PART NO. -----	PRIME CONTRACTOR -----	COMPONENT -----	DATA SHEET NO. -----
FUTURECRAFT	--	RCA	VALVE, COLD GAS JET	4.3.3-57
GOULD	PA 4064	TRW	TRANSDUCER, PRESSURE	4.4.1-13
GOULD	PA4022	JPL	TRANSDUCER, PRESSURE	4.4.1-7
GOULD	PA4062	TRW	TRANSDUCER, PRESSURE	4.4.1-9
GOULD	PA493	TRW SYSTEMS	TRANSDUCER, PRESSURE	4.4.1-5
GOULD	PA850-150- 17575	BELL AEROSPACE	TRANSDUCER, PRESSURE	4.4.1-3
GOULD	S53	MCDONNELL DOUGLAS	TRANSDUCER, PRESSURE	4.4.1-15
HAMILTON STANDARD	SV 748525	CANADIAN GOV	THRUSTER, HYDRAZINE	4.3.1-17
HAMILTON STANDARD	SV 748563	LMSC	THRUSTER, HYDRAZINE	4.3.1-101
HAMILTON STANDARD	SV 755446	PHILCO-FORD	THRUSTER, HYDRAZINE	4.3.1-57
HAMILTON STANDARD	SV748562	LSMS	THRUSTER, HYDRAZINE	4.3.1-31
HAMILTON STANDARD	SV755436	--	THRUSTER, HYDRAZINE	4.3.1-61
HAMILTON STANDARD	SV755437	--	THRUSTER, HYDRAZINE	4.3.1-21
HAMILTON STANDARD	SV755458-1	RCA	THRUSTER, HYDRAZINE	4.3.1-71
HTL INDUSTRIES	146650-10	GENERAL DYNAMICS	REGULATOR, GAS PRESSURE	4.2.6-37
HTL INDUSTRIES	146650-11	GENERAL DYNAMICS	REGULATOR, GAS PRESSURE	4.2.6-39
HTL INDUSTRIES	155340-4	ROCKWELL	VALVE, CHECK	4.2.5-1

5.2 MANUFACTURER-ORDERED DATA SUMMARY

MANUFACTURER -----	PART NO. -----	PRIME CONTRACTOR -----	COMPONENT -----	DATA SHEET NO. -----
HTL INDUSTRIES	193790-4	ROCKWELL	VALVE, RELIEF	4.2.4-17
HTL INDUSTRIES	212870-2	TRW SYSTEMS	VALVE, CHECK	4.2.5-9
HTL INDUSTRIES	230200-2	TRW SYSTEMS	VALVE, RELIEF	4.2.4-13
HTL INDUSTRIES	255360-3	MARTIN MARIETTA	VALVE, CHECK	4.2.5-3
HTL INDUSTRIES	255510-2	MARTIN MARIETTA	VALVE, CHECK	4.2.5-11
HTL INDUSTRIES	255620-3	MARTIN MARIETTA	VALVE, FILL & VENT	4.2.7-11
HUGHES AIRCRAFT	3194300	--	THRUSTER, HYDRAZINE	4.3.1-53
HUGHES AIRCRAFT	325-7167	--	VALVE, FILL & VENT	4.2.7-5
HUGHES AIRCRAFT	3251415-101	--	THRUSTER, HYDRAZINE	4.3.1-27
HUGHES AIRCRAFT	328F410-100	--	THRUSTER, HYDRAZINE	4.3.1-67
HUGHES AIRCRAFT	3354474	--	THRUSTER, HYDRAZINE	4.3.1-49
HYDRAULIC RESERCH	48002330	RCA	VALVE HYDRAZINE THRUSTER	4.3.2-23
MAROTTA	226154	AEROJET	REGULATOR, GAS PRESSURE	4.2.6-9
MAROTTA	227174	AVCO	VALVE, COLD GAS JET	4.3.3-35
MAROTTA	280096	NORTHROP, ETC	VALVE, PROPELLANT ISOLATION	4.2.3-57
MAROTTA	280601	--	REGULATOR, GAS PRESSURE	4.2.6-31
MAROTTA	280778	--	REGULATOR, GAS PRESSURE	4.2.6-43

5.2 MANUFACTURER-ORDERED DATA SUMMARY

MANUFACTURER -----	PART NO. -----	PRIME CONTRACTOR -----	COMPONENT -----	DATA SHEET NO. -----
MAROTTA	281022	--	VALVE, PROPELLANT ISOLATION	4.2.3-65
MAROTTA	281233	GENERAL DYNAMICS	VALVE, PROPELLANT ISOLATION	4.2.3-89
MAROTTA	801602	--	VALVE, CHECK	4.2.5-7
MOOG	20-315AA	ROCKET RESEARCH	VALVE, HYDRAZINE THRUSTER	4.3.2-27
MOOG	50-399	ROCKET RESEARCH	VALVE, HYDRAZINE THRUSTER	4.3.2-11
MOOG	50-415	ROCKET RESEARCH	VALVE, HYDRAZINE THRUSTER	4.3.2-25
MOOG	50-436	RCA	VALVE, PROPELLANT ISOLATION	4.2.3-33
MOOG	50-441	TRW SYSTEMS	VALVE, HYDRAZINE THRUSTER	4.3.2-21
PYRONETICS	EQ13-50	RCA	VALVE, PROPELLANT ISOLATION	4.2.3-37
PYRONETICS	1146, 1176	AVCO, HUGHES, ETC	VALVE, FILL & VENT	4.2.7-17
PYRONETICS	1176-16 & 1832-1	--	VALVE, FILL & VENT	4.2.7-19
PYRONETICS	1811-4, 1821- 1	NOZAKI	VALVE, FILL & VENT	4.2.7-21
PYRONETICS	1819	AVCO, LOCKHEED, ETC	VALVE, FILL & VENT	4.2.7-23
PYRONETICS	1831	MARTIN MARIETTA	VALVE, FILL & VENT	4.2.7-9
ROCKET RESEARCH	MR-50A	LOCKHEED	THRUSTER, HYDRAZINE	4.3.1-79
ROCKET RESEARCH	MR-50E	PHILCO-FORD, MARCONI	THRUSTER, HYDRAZINE	4.3.1-91

5.2 MANUFACTURER-ORDERED DATA SUMMARY

MANUFACTURER -----	PART NO. -----	PRIME CONTRACTOR -----	COMPONENT -----	DATA SHEET NO. -----
ROCKET RESEARCH	MR-50F	MARTIN MARIETTA	THRUSTER, HYDRAZINE	4.3.1-83
ROCKET RESEARCH	MR-6C	PHILCO FORD, MARCONI	THRUSTER, HYDRAZINE	4.3.1-39
ROCKET RESEARCH	MR-74A	FAIRCHILD	THRUSTER, HYDRAZINE	4.3.1-1
ROCKET RESERCH	MR-50H	PARKER-HANNIFIN	THRUSTER, HYDRAZINE	4.3.1-75
ROSEMOUNT	110MA	--	TRANSDUCER, TEMPERATURE	4.4.2-5
ROSEMOUNT	118MA	--	TRANSDUCER, TEMPERATURE	4.4.2-7
ROSEMOUNT	118ME	--	TRANSDUCER, TEMPERATURE	4.4.2-3
ROSEMOUNT	118MF	--	TRANSDUCER, TEMPERATURE	4.4.2-11
ROSEMOUNT	1332	CELESCO	TRANSDUCER, PRESSURE	4.4.1-11
ROSEMOUNT	137MA		TRANSDUCER, TEMPERATURE	4.4.2-9
ROSEMOUNT	171 SERIES	--	TRANSDUCER, TEMPERATURE	4.4.2-1
SIEBELAIR	1488	AEROJET	VALVE, RELIEF	4.2.4-19
SIEBELAIR	2900-0 THRU-7	AEROJET	VALVE, COLD GAS JET	4.3.3-7
SIEBELAIR	2950-0 & A/R	AEROJET	VALVE, COLD GAS JET	4.3.3-29
STERER	22690	LOCKHEED	VALVE, COLD GAS JET	4.3.3-41
STERER	24050	LTV	VALVE, COLD GAS JET	4.3.3-27

5.2 MANUFACTURER-ORDERED DATA SUMMARY

MANUFACTURER -----	PART NO. -----	PRIME CONTRACTOR -----	COMPONENT -----	DATA SHEET NO. -----
STERER	24060	LTV	VALVE, COLD GAS JET	4.3.3-33
STERER	25210-1	--	REGULATOR, GAS PRESSURE	4.2.6-5
STERER	29830	MARTIN MARIETTA	VALVE, COLD GAS JET	4.3.3-15
STERER	33120-1	--	REGULATOR, GAS PRESSURE	4.2.6-15
STERER	33130	NASA	VALVE, COLD GAS JET	4.3.3-23
STERER	34810	--	REGULATOR, GAS PRESSURE	4.2.6-13
STERER	34880	TRW SYSTEMS	VALVE, COLD GAS JET	4.3.3-13
STERER	46240	MARTIN MARIETTA	REGULATOR, GAS PRESSURE	4.2.6-7
STERER	48343	--	VALVE, RELIEF	4.2.4-5
TAVCO	232129	PHILCO FORD	VALVE, CHECK	4.2.5-13
TAVCO	2324212	--	VALVE, CHECK	4.2.5-5
TAVCO	2344344	--	REGULATOR, GAS PRESSURE	4.2.6-17
TAVCO	2346334	--	REGULATOR, GAS PRESSURE	4.2.6-45
TAVCO	2346340	--	REGULATOR, GAS PRESSURE	4.2.6-3
TAVCO	234635	--	REGULATOR, GAS PRESSURE	4.2.6-25
TAVCO	2391214	--	VALVE, RELIEF	4.2.4-1
TAVCO	2391237	--	VALVE, RELIEF	4.2.4-21

5.2 MANUFACTURER-ORDERED DATA SUMMARY

MANUFACTURER	PART NO.	PRIME CONTRACTOR	COMPONENT	DATA SHEET NO.
TAVCO	2391246	--	VALVE, RELIEF	4.2.4-11
TAVCO	2394222	--	VALVE, RELIEF	4.2.4-27
TAVCO	2396245	--	VALVE, RELIEF	4.2.4-23
TAVCO	2396249	--	VALVE, RELIEF	
TAYCO	2-2518	TRW SYSTEMS	TRANSDUCER, TEMPERATURE	4.4.2-13
TRW SYSTEMS	JPL 10000055	--	REGULATOR, GAS PRESSURE	4.2.6-35
TRW SYSTEMS	MRE-0,1	TRW SYSTEMS	THRUSTER, HYDRAZINE	4.3.1-13
TRW SYSTEMS	MRE-4-A-1	TRW, RCA	THRUSTER, HYDRAZINE	4.3.1-43
TRW SYSTEMS	409708	RCA	VALVE, FILL & VENT	4.2.7-25
TRW SYSTEMS	410618	TRW SYSTEMS	THRUSTER, HYDRAZINE	4.3.1-35
VACCO	E-89196-4-15	MARTIN MARIETTA	FILTER, LIQUID	4.2.2-11
VACCO	F1D010178-01	MARTIN MARIETTA	FILTER, GAS	4.2.1-7
VACCO	F1D10064-01	HUGHES AIRCRAFT	FILTER, LIQUID	4.2.2-1
VACCO	F1D10093-01,- 02	MARTIN MARIETTA	FILTER, LIQUID	4.2.2-25
VACCO	F1D10106-01	ROCKET RESERCH	FILTER, LIQUID	4.2.2-21
VACCO	F1D10106-02	ROCKET RESERCH	FILTER, LIQUID	4.2.2-23
VACCO	F1D10132-01	ROCKWELL	FILTER, GAS	4.2.1-19

5.2 MANUFACTURER-ORDERED DATA SUMMARY

MANUFACTURER	PART NO.	PRIME CONTRACTOR	COMPONENT	DATA SHEET NO.
VACCO	F1D10151-01	HAMILTON STANDARD	FILTER, LIQUID	4.2.2-5
VACCO	F1D10180-01	HUGHES	FILTER, GAS	4.2.1-3
VACCO	F1D10182-01,- 02	HAMILTON STANDARD	FILTER, LIQUID	4.2.2-3
VACCO	SL-81019	BOEING	FILTER, GAS	4.2.1-5
VACCO	SL-81500	NAA	FILTER, GAS	4.2.1-9
VACCO	S2-8846	GRUMMAN	FILTER, GAS	4.2.1-11
VALCOR	V27200-1206- 121	GENERAL ELECTRIC	VALVE, PROPELLANT ISOLATION	4.2.3-61
VALCOR	V27200-195	TRW SYSTEMS	VALVE, PROPELLANT ISOLATION	4.2.3-49
VALCOR	V27200-288	GE	VALVE, COLD GAS JET	4.3.3-17
VALCOR	V27200-320	SUNNY LTD., TOKYO	VALVE, PROPELLANT ISOLATION	4.2.3-105
VALCOR	V27200-339	NASA/GODDARD	VALVE, PROPELLANT ISOLATION	4.2.3-41
VALCOR	V27200-411	HAMILTON STANDARD	VALVE, PROPELLANT ISOLATION	4.2.3-53
VALCOR	V27200-437	FAIRCHILD CAMERA	VALVE, PROPELLANT ISOLATION	4.2.3-93
VALCOR	V27200-454	ADAR ENGINEERING, PARIS FRANCE	VALVE, PROPELLANT ISOLATION	4.2.3-25
VALCOR	V27200-510	GRUMMAN	VALVE, COLD GAS JET	4.3.3-39
VALCOR	V27200-513	GRUMMAN	VALVE, PROPELLANT ISOLATION	4.2.3-29

5.2 MANUFACTURER-ORDERED DATA SUMMARY

MANUFACTURER -----	PART NO. -----	PRIME CONTRACTOR -----	COMPONENT -----	DATA SHEET NO. -----
VALCOR	V47200-16	GRUMMAN	VALVE, PROPELLANT ISOLATION	4.2.3-81
VALCOR	V67000-02	--	VALVE, COLD GAS JET	4.3.3-1
WHITTAKER	123035	LOCKHEED	REGULATOR, GAS PRESSURE	4.2.6-49
WHITTAKER	137455	LOCKHEED	VALVE, PROPELLANT ISOLATION	4.2.3-21
WHITTAKER	145485(-7)	LOCKHEED	VALVE, RELIEF	4.2.4-7
WINTEC	15241-685	RCA	FILTER, LIQUID	4.2.2-7
WRIGHT COMPONENTS	12183	NRL	VALVE, FILL & VENT	4.2.7-7
WRIGHT COMPONENTS	15398	AVCO SYSTEMS	VALVE, COLD GAS JET	4.3.3-59
WRIGHT COMPONENTS	15447	--	VALVE, PROPELLANT ISOLATION	4.2.3-1
WRIGHT COMPONENTS	15457	NASA/GODDARD	VALVE, COLD GAS JET	4.3.3-61
WRIGHT COMPONENTS	15512-1	--	VALVE, PROPELLANT ISOLATION	4.2.3-5
WRIGHT COMPONENTS	15548	NAVAL RESERCH LAB	VALVE, HYDRAZINE THRUSTER	4.3.2-3
WRIGHT COMPONENTS	15607	NASA/GODDARD	VALVE, COLD GAS JET	4.3.3-3
WRIGHT COMPONENTS	15609	NASA/GODDARD	VALVE, COLD GAS JET	4.3.3-63
WRIGHT COMPONENTS	15617-14	HAMILTON STANDARD	VALVE, HYDRAZINE THRUSTER	4.3.2-1
WRIGHT COMPONENTS	15625	HAMILTON STANDARD	VALVE, PROPELLANT ISOLATION	4.2.3-9
WRIGHT COMPONENTS	15626	HAMILTON STANDARD	VALVE, COLD GAS JET	4.3.3-43

5.2 MANUFACTURER-ORDERED DATA SUMMARY

MANUFACTURER -----	PART NO. -----	PRIME CONTRACTOR -----	COMPONENT -----	DATA SHEET NO. -----
WRIGHT COMPONENTS	15675	NAVAL RESERCH LAB	VALVE, PROPELLANT ISOLATION	4.2.3-13
WRIGHT COMPONENTS	15676	HAMILTON STANDARD	VALVE, HYDRAZINE THRUSTER	4.3.2-9
WRIGHT COMPONENTS	15749	AVCO SYSTEMS	VALVE, COLD GAS JET	
WRIGHT COMPONENTS	15750	AVCO SYSTEM DIV.	VALVE, COLD GAS JET	4.3.3-47
WRIGHT COMPONENTS	15751	GRUMMAN	VALVE, COLD GAS JET	4.3.3-65

5.3 PROGRAM-ORDERED DATA SUMMARY

PROGRAM	COMPONENT	MANUFACTURER	PART NO.	DATA SHEET NO.
AAP	VALVE, RELIEF	AMETEK/CALMEC	1049	4.2.4-33
AE	FILTER, LIQUID	WINTEC	15241-685	4.2.2-7
AE	VALVE, FILL & VENT	TRW SYSTEMS	409708	4.2.7-25
AE	VALVE, HYDRAZINE THRUSTER	FAIRCHILD	EQ2-379	4.3.2-17
AE	VALVE, PROPELLANT ISOLATION	PYRONETICS	EQ13-50	4.2.3-37
AEROBEE	REGULATOR, GAS PRESSURE	ALLEN DESIGN	13890	4.2.6-47
AEROBEE	VALVE, COLD GAS JET	ALLEN DESIGN	13515	4.3.3-9
AEROBEE	VALVE, COLD GAS JET	ALLEN DESIGN	13535	4.3.3-37
AEROBEE	VALVE, COLD GAS JET	ALLEN DESIGN	13705	4.3.3-19
AEROBEE	VALVE, COLD GAS JET	ALLEN DESIGN	13854	4.3.3-21
AEROBEE	VALVE, COLD GAS JET	ALLEN DESIGN	13880	4.3.3-5
AEROBEE	VALVE, PROPELLANT ISOLATION	VALCOR	V27200-339	4.2.3-41
AEROBEE, HI STAR, MK III, SCOOP, SUPER CHIEF	VALVE, COLD GAS JET	SIEBELAIR	2900-0 THRU-7	4.3.3-7
AEROJET MFG.	VALVE, HYDRAZINE THRUSTER	ALLEN DESIGN	13880	4.3.2-5
AGENA	VALVE, COLD GAS JET	STERER	22690	4.3.3-41
AGENA	VALVE, PROPELLANT ISOLATION	WHITTAKER	137455	4.2.3-21

5.3 PROGRAM-ORDERED DATA SUMMARY

PROGRAM	COMPONENT	MANUFACTURER	PART NO.	DATA SHEET NO.
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AGENA DISCOVERER	VALVE, RELIEF	WHITTAKER	145485(-7)	4.2.4-7
ANIK, WESTAR, MARISAT	THRUSTER, HYDRAZINE	HUGHES AIRCRAFT	3251415-101	4.3.1-27
APOLLO	FILTER, GAS	AIRCRAFT POROUS MEDIA	AC6875853	4.2.1-1
APOLLO	FILTER, GAS	AIRCRAFT POROUS MEDIA	AC6875855	4.2.1-13
APOLLO	FILTER, GAS	BRUNSWICK	11204-501	4.2.1-23
APOLLO	FILTER, GAS	BRUNSWICK	12204-505	4.2.1-25
APOLLO	FILTER, GAS	BRUNSWICK	12204-508	4.2.1-21
APOLLO	FILTER, GAS	BRUNSWICK	15204-516	4.2.1-27
APOLLO	FILTER, GAS	VACCO	F1D10132-01	4.2.1-19
APOLLO	FILTER, GAS	VACCO	SL-81500	4.2.1-9
APOLLO	FILTER, LIQUID	BRUNSWICK	15241-525	4.2.2-15
APOLLO	FILTER, LIQUID	BRUNSWICK	15241-526	4.2.2-13
APOLLO	REGULATOR, GAS PRESSURE	MAROTTA	226154	4.2.6-9
APOLLO	TRANSDUCER, TEMPERATURE	ROSEMOUNT	118ME	4.4.2-3
APOLLO	VALVE, PROPELLANT ISOLATION	CONSOLIDATED CONTROLS	3490-4	4.2.3-97

5.3 PROGRAM-ORDERED DATA SUMMARY

PROGRAM -----	COMPONENT -----	MANUFACTURER -----	PART NO. -----	DATA SHEET NO. -----
APOLLO	VALVE, PROPELLANT ISOLATION	CONSOLIDATED CONTROLS	3490-5	4.2.3-85
APOLLO	VALVE, PROPELLANT ISOLATION	CONSOLIDATED CONTROLS	669900	4.2.3-17
APOLLO	VALVE, PROPELLANT ISOLATION	VALCOR	V27200-437	4.2.3-93
APOLLO	VALVE, RELIEF	SIEBELAIR	1488	4.2.4-19
APOLLO COMMAND MOD RCS,LMRCS	REGULATOR, GAS PRESSURE	FAIRCHILD	63-036	4.2.6-21
APOLLO, ATS, ETC	VALVE, FILL & VENT	PYRONETICS	1146, 1176	4.2.7-17
APS	VALVE, PROPELLANT ISOLATION	VALCOR	V27200-320	4.2.3-105
ATS D/E	VALVE, COLD GAS JET	WRIGHT COMPONENTS	15398	4.3.3-59
ATS F&G	THRUSTER, HYDRAZINE	ROCKET RESEARCH	MR-74A	4.3.1-1
CANADIAN SATELLITE	FILTER, LIQUID	VACCO	F1D10151-01	4.2.2-5
CELESCO GLIDE BOMB	TRANSDUCER, PRESSURE	ROSEMOUNT	1332	4.4.1-11
CENTAUR	REGULATOR, GAS PRESSURE	HTL INDUSTRIES	146650-10	4.2.6-37
CENTAUR	REGULATOR, GAS PRESSURE	HTL INDUSTRIES	146650-11	4.2.6-39
CLASSIFIED	FILTER, GAS	BRUNSWICK	3228-506	4.2.1-15
CLASSIFIED	THRUSTER, HYDRAZINE	HAMILTON STANDARD	SV 748563	4.3.1-101
CLASSIFIED	THRUSTER, HYDRAZINE	HAMILTON STANDARD	SV748562	4.3.1-31

5.3 PROGRAM-ORDERED DATA SUMMARY

PROGRAM -----	COMPONENT -----	MANUFACTURER -----	PART NO. -----	DATA SHEET NO. -----
CLASSIFIED	VALVE, COLD GAS JET	COLT INDUSTRIES	CRTC-7	4.3.3-51
CLASSIFIED	VALVE, COLD GAS JET	FUTURECRAFT	--	4.3.3-57
CLASSIFIED	VALVE, HYDRAZINE THRUSTER	MOOG	50-415	4.3.2-25
CLASSIFIED	VALVE, PROPELLANT ISOLATION	VALCOR	V27200-411	4.2.3-53
COMSAT	VALVE, PROPELLANT ISOLATION	VALCOR	V27200-454	4.2.3-25
COMSAT INTELSAT IV	FILTER, LIQUID	VACCO	F1D10064-01	4.2.2-1
COMSAT, VIKING, ETC	VALVE, FILL & VENT	PYRONETICS	1819	4.2.7-23
CTS	FILTER, LIQUID	VACCO	F1D10182-01,- 02	4.2.2-3
CTS	THRUSTER, HYDRAZINE	HAMILTON STANDARD	SV 748525	4.3.1-17
CTS	VALVE, HYDRAZINE THRUSTER	WRIGHT COMPONENTS	15617-14	4.3.2-1
DELTA	TRANSDUCER, PRESSURE	GOULD	PA493	4.4.1-5
DELTA	VALVE, COLD GAS JET	ALLEN DESIGN	13422	4.3.3-11
DELTA THOR	VALVE, COLD GAS JET	CONSOLIDATED CONTROLS	72520	4.3.3-31
DSCS	TRANSDUCER, PRESSURE	GOULD	PA 4064	4.4.1-13
EARTH ATMOSPHERE EXPLORER	VALVE, PROPELLANT ISOLATION	MOOG	50-436	4.2.3-33

5.3 PROGRAM-ORDERED DATA SUMMARY

PROGRAM	COMPONENT	MANUFACTURER	PART NO.	DATA SHEET NO.
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ELMS	VALVE, COLD GAS JET	VALCOR	V27200-510	4.3.3-39
ELMS	VALVE, COLD GAS JET	WRIGHT COMPONENTS	15751	4.3.3-65
ELMS	VALVE, PROPELLANT ISOLATION	VALCOR	V27200-513	4.2.3-29
ERB	FILTER, LIQUID	VACCO	F1D10106-02	4.2.2-23
ERTS	FILTER, LIQUID	VACCO	F1D10106-01	4.2.2-21
ERTS	REGULATOR, GAS PRESSURE	STERER	33120-1	4.2.6-15
ERTS	VALVE, COLD GAS JET	STERER	33130	4.3.3-23
FAIR II	VALVE, FILL & VENT	ECKEL VALVE	AF56C-293	4.2.7-15
FAIR II	VALVE, HYDRAZINE THRUSTER	ECKEL VALVE	AF56C-279	4.3.2-13
FLT-SAT-COM	TRANSDUCER, TEMPERATURE	TAYCO	2-2518	4.4.2-13
FLTSATCOM	THRUSTER, HYDRAZINE	TRW SYSTEMS	MRE-0.1	4.3.1-13
FLTSATCOM	TRANSDUCER, PRESSURE	GOULD	PA4062	4.4.1-9
IMP I/H & LES 8/9	VALVE, COLD GAS JET	WRIGHT COMPONENTS	15607	4.3.3-3
INTELSAT IV	THRUSTER, HYDRAZINE	HUGHES AIRCRAFT	3194300	4.3.1-53
INTELSAT IV A WESTAR ANIK	VALVE, FILL & VENT	HUGHES AIRCRAFT	325-7167	4.2.7-5
INTELSAT IVA	THRUSTER, HYDRAZINE	HUGHES AIRCRAFT	3354474	4.3.1-49
INTELSAT 111	THRUSTER, HYDRAZINE	TRW SYSTEMS	MRE-4-A-1	4.3.1-43

5.3 PROGRAM-ORDERED DATA SUMMARY

PROGRAM -----	COMPONENT -----	MANUFACTURER -----	PART NO. -----	DATA SHEET NO. -----
JAPANESE 'N' LAUNCH VIJICLE	VALVE, HYDRAZINE THRUSTER	MOOG	50-441	4.3.2-21
LEM	FILTER, GAS	VACCO	S2-8846	4.2.1-11
LEM	VALVE, PROPELLANT ISOLATION	VALCOR	V47200-16	4.2.3-81
LES 8/9, DISCOS, SOLRAD A AND B	VALVE, PROPELLANT ISOLATION	WRIGHT COMPONENTS	15625	4.2.3-9
LM	REGULATOR, GAS PRESSURE	FAIRCHILD	385000	4.2.6-19
LORV	VALVE, COLD GAS JET	MAROTTA	227174	4.3.3-35
LOW COAST STAND. SPACE EQUIP.	THRUSTER, HYDRAZINE	BELL AEROSPACE	8760	4.3.1-9
LUNAR ORBITER	FILTER, GAS	VACCO	SL-81019	4.2.1-5
LUNAR ORBITER	VALVE, RELIEF	AMETEK/CALMEC	615	4.2.4-29
L10-11 AIRCRAFT	TRANSDUCER, TEMPERATURE	ROSEMOUNT	137MA	4.4.2-9
MARINER '69	REGULATOR, GAS PRESSURE	TRW SYSTEMS	JPL 10000055	4.2.6-35
MARINER AND VIKING	FILTER, LIQUID	VACCO	F1010093-01,- 02	4.2.2-25
MARINER MARS '71	REGULATOR, GAS PRESSURE	STERER	25210-1	4.2.6-5
MARINER 69(M2)	VALVE, CHECK	HTL INDUSTRIES	212870-2	4.2.5-9
MARINER 69(M2)	VALVE, RELIEF	HTL INDUSTRIES	230200-2	4.2.4-13

5.3 PROGRAM-ORDERED DATA SUMMARY

PROGRAM -----	COMPONENT -----	MANUFACTURER -----	PART NO. -----	DATA SHEET NO. -----
MARINER 71	VALVE, CHECK	HTL INDUSTRIES	255510-2	4.2.5-11
MARINER 71	VALVE, RELIEF	AMETEK/CALMEC	1113	4.2.4-15
MARINER 71, VIKING ORBITER , 75	REGULATOR, GAS PRESSURE	CONSOLIDATED CONTROLS	6894	4.2.6-33
MINUTEMEN 111	REGULATOR, GAS PRESSURE	FAIRCHILD	332000	4.2.6-29
MINUTEMAN III, PSRE	TRANSDUCER, PRESSURE	GOULD	PA850-150- 17575	4.4.1-3
MINUTEMEN 111	REGULATOR, GAS PRESSURE	CONSOLIDATED CONTROLS	6890	4.2.6-27
MOL	VALVE, COLD GAS JET	VALCOR	V67000-02	4.3.3-1
MOL RCS	VALVE, RELIEF	AMETEK/CALMEC	1039	4.2.4-31
MSD	THRUSTER, HYDRAZINE	HAMILTON STANDARD	SV755436	4.3.1-61
MSD	THRUSTER, HYDRAZINE	HAMILTON STANDARD	SV755437	4.3.1-21
MSD	VALVE, FILL & VENT	WRIGHT COMPONENTS	12183	4.2.7-7
MVM 73	TRANSDUCER, PRESSURE	GOULD	PA4022	4.4.1-7
N. ROCKET	VALVE, FILL & VENT	PYRONETICS	1811-4, 1821- 1	4.2.7-21
NATO 111	THRUSTER, HYDRAZINE	HAMILTON STANDARD	SV 755446	4.3.1-57
NIMBUS&OAO	VALVE, PROPELLANT ISOLATION	VALCOR	V27200-1206-	4.2.3-61

5.3 PROGRAM-ORDERED DATA SUMMARY

PROGRAM -----	COMPONENT -----	MANUFACTURER -----	PART NO. -----	DATA SHEET NO. -----
			121	
NRL RADIATION EXPERIMENT	VALVE, PROPELLANT ISOLATION	WRIGHT COMPONENTS	15447	4.2.3-1
OA0	REGULATOR, GAS PRESSURE	FAIRCHILD	601000	4.2.6-1
OA0	REGULATOR, GAS PRESSURE	FAIRCHILD	617000	4.2.6-11
OA0	VALVE, COLD GAS JET	FAIRCHILD	683000	4.3.3-55
OCEANIC APPL	TRANSDUCER, TEMPERATURE	ROSEMOUNT	171 SERIES	4.4.2-1
DS0-1	FILTER, GAS	VACCO	F1010180-01	4.2.1-3
OWS	VALVE, RELIEF	FAIRCHILD	834000	4.2.4-3
P-50	VALVE, FILL & VENT	CONSOLIDATED CONTROLS	72855	4.2.7-3
P-95	VALVE, HYDRAZINE THRUSTER	MOOG	50-399	4.3.2-11
P-95	VALVE, PROPELLANT ISOLATION	CONSOLIDATED CONTROLS	3795	4.2.3-73
P-95, BLOCK III	THRUSTER, HYDRAZINE	ROCKET RESERCH	MR-50H	4.3.1-75
P-95, BLOCK 1	THRUSTER, HYDRAZINE	ROCKET RESEARCH	MR-50A	4.3.1-79
PIONEER 10&11, FLTSATCOM	THRUSTER, HYDRAZINE	TRW SYSTEMS	410618	4.3.1-35
PROJECT 'FIRE'	VALVE, COLD GAS JET	STERER	24050	4.3.3-27
PROJECT 'FIRE'	VALVE, COLD GAS JET	STERER	24060	4.3.3-33

5.3 PROGRAM-ORDERED DATA SUMMARY

PROGRAM	COMPONENT	MANUFACTURER	PART NO.	DATA SHEET NO.
PROJECT 'PRIME'	VALVE, COLD GAS JET	STERER	29830	4.3.3-15
PROJECT '169'	VALVE, COLD GAS JET	STERER	34880	4.3.3-13
P95	VALVE, FILL & VENT	CONSOLIDATED CONTROLS	72580	4.2.7-1
P95 SATELLITE	FILTER, LIQUID	BRUNSWICK	15312-501-1	4.2.2-17
P95 SATILLITE	FILTER, LIQUID	BRUNSWICK	15312-501-3	4.2.2-19
RE-ENTRY, CLASSIFIED	VALVE, COLD GAS JET	VALCOR	V27200-288	4.3.3-17
REA-B	VALVE, COLD GAS JET	WRIGHT COMPONENTS	15609	4.3.3-63
SATURN 1V-B	REGULATOR, GAS PRESSURE	FAIRCHILD	65-168	4.2.6-23
SATURN 1VB & S-1VB	REGULATOR, GAS PRESSURE	FAIRCHILD	679000	4.2.6-41
SE-5	VALVE, CHECK	HTL INDUSTRIES	155340-4	4.2.5-1
SE-5	VALVE, RELIEF	HTL INDUSTRIES	193790-4	4.2.4-17
SKYLAB	TRANSDUCER, TEMPERATURE	ROSEMOUNT	110MA	4.4.2-5
SMS, METEOSAT	THRUSTER, HYDRAZINE	ROCKET RESEARCH	MR-50E	4.3.1-91
SMS, METEOSAT	THRUSTER, HYDRAZINE	ROCKET RESEARCH	MR-6C	4.3.1-39
SOLRAD II A & B	VALVE, COLD GAS JET	WRIGHT COMPONENTS	15626	4.3.3-43
SOLRAD X	VALVE, HYDRAZINE THRUSTER	WRIGHT COMPONENTS	15548	4.3.2-3

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5.3 PROGRAM-ORDERED DATA SUMMARY

PROGRAM -----	COMPONENT -----	MANUFACTURER -----	PART NO. -----	DATA SHEET NO. -----
SOLRAD X 1	VALVE, COLD GAS JET	WRIGHT COMPONENTS	15750	4.3.3-47
SOLRAD X 1	VALVE, HYDRAZINE THRUSTER	WRIGHT COMPONENTS	15676	4.3.2-9
SOLRAD X1	VALVE, COLD GAS JET	WRIGHT COMPONENTS	15749	
SOLRAD X1	VALVE, PROPELLANT ISOLATION	WRIGHT COMPONENTS	15675	4.2.3-13
SOLRAD-X	VALVE, PROPELLANT ISOLATION	WRIGHT COMPONENTS	15512-1	4.2.3-5
SPACE SHUTTLE	VALVE, PROPELLANT ISOLATION	CIRCLE SEAL	V-4339	4.2.3-69
SPACE SHUTTLE	VALVE, PROPELLANT ISOLATION	CIRCLE SEAL	V-4340	4.2.3-77
SPACE SHUTTLE	VALVE, PROPELLANT ISOLATION	CIRCLE SEAL	V-4341	4.2.3-45
SPACS AND HARP	VALVE, COLD GAS JET	COLT INDUSTRIES	CRTS-2	4.3.3-53
SPARTAN	TRANSDUCER, PRESSURE	GOULD	S53	4.4.1-15
STINGER	VALVE, PROPELLANT ISOLATION	MAROTTA	281233	4.2.3-89
STRYTI	VALVE, COLD GAS JET	COLT INDUSTRIES	CRTC-6	4.3.3-49
SUPER CHIEF & NRL SOUNDING ROCKETS	VALVE, COLD GAS JET	SIEBELAIR	2950-0 & A/R	4.3.3-29
TIP-II	THRUSTER, HYDRAZINE	HAMILTON STANDARD	SV755458-1	4.3.1-71
TIP-II	VALVE, FILL & VENT	PYRONETICS	1176-16 & 1832-1	4.2.7-19
TIP-II	VALVE, HYDRAZINE THRUSTER	HYDRAULIC RESERCH	48002330	4.3.2-23

5.3 PROGRAM-ORDERED DATA SUMMARY

PROGRAM -----	COMPONENT -----	MANUFACTURER -----	PART NO. -----	DATA SHEET NO. -----
TITAN III	FILTER, LIQUID	VACCO	E-89196-4-15	4.2.2-11
TITAN TRANSTAGE	VALVE, HYDRAZINE THRUSTER	MOOG	20-315AA	4.3.2-27
USAF	FILTER, GAS	BRUNSWICK	14228-502	4.2.1-17
VIKING	FILTER, LIQUID	BRUNSWICK	15228-572	4.2.2-27
VIKING '75	VALVE, FILL & VENT	PYRONETICS	1831	4.2.7-9
VIKING '75	VALVE, RELIEF	STERER	48343	4.2.4-5
VIKING ORBITER '75	VALVE, CHECK	HTL INDUSTRIES	255360-3	4.2.5-3
VIKING ORBITER '75	VALVE, FILL & VENT	HTL INDUSTRIES	255620-3	4.2.7-11
VIKING RCS REA	THRUSTER, HYDRAZINE	ROCKET RESEARCH	MR-50F	4.3.1-83
VO'75	REGULATOR, GAS PRESSURE	STERER	46240	4.2.6-7
X-15	VALVE, RELIEF	FAIRCHILD	56-399	4.2.4-25
777	FILTER, LIQUID	BRUNSWICK	15241-647	4.2.2-9

6.1 Abbreviations

°C	Celsius Temperature
°F	Fahrenheit Temperature
diam.	Diameter
hr	Hour
He	Helium
i.d.	Inside Diameter
in	Inch
in ³	Cubic Inch
kg	Kilogram
lbf	Pound Force
lbm	Pound Mass
lg	Long
max.	Maximum
min.	Minimum
mo.	Month
N ₂	Nitrogen
N ₂ H ₄	Hydrazine
N/A	Not Applicable
N/cm ²	Newtons per Square Centimeter
o.d.	Outside Diameter
oz.	Ounce
O/A lg	Over-all Length
O ₂	Oxygen

6.1 Abbreviations (cont'd)

psi	Pounds Per Square Inch
psia	Pounds Per Square Inch Absolute
psid	Pounds Per Square Inch Differential
scch	Standard Cubic Centimeters Per Hour
sccm	Standard Cubic Centimeters Per Minute
sccs	Standard Cubic Centimeters Per Second
scfm	Standard Cubic Feet Per Minute
sec.	Second
(xx)	Reference Number (See Section 6.4)

6.2 Acronyms

AAP	Aerodynamics Advisory Panel
AE	Atmospheric Explorer
APS	Auxiliary Propulsion System
ATS	Applications Technology Satellite
CCC	Consolidated Controls Corp.
COMSAT	Communications Satellite
CTS	Communications Technology Satellite
DSCS	Defense Satellite Communication System
EAE	Earth Atmosphere Explorer
ERTS	Earth Resources Technology Satellite
ESRO	European Space Research Organization
FLT-SAT-COM	Fleet Satellite Communications Network
GD/CA	General Dynamics/Convair Aerospace Div.
GSE	Ground Support Equipment
GSFC	Goddard Space Flight Center
HARP	High Altitude Research Program
HEOS	Highly Eccentric Orbit Satellite
INTELSAT IV	ITT Satellite
ISIS	International Satellite for Ionospheric Studies
JPL	Jet Propulsion Laboratory
LEM	Lunar Excursion Module
LM	Lunar Module
LMSC	Lockheed Missiles & Space Co.
MJS	Mariner Jupiter Saturn Spacecraft
MM '71	Mariner Mars '71

6.2 Acronyms (cont'd)

MMC	Martin Marietta Corp.
MOL	Manned Orbiting Laboratory
MSD	Multiple Satellite Dispenser
MSFC	Marshall Space Flight Center
MVM	Mariner Venus Mars Spacecraft
NASA	National Aeronautics and Space Administration
NATO	North Atlantic Treaty Organization
NRL	Naval Research Laboratory
OAO	Orbiting Astronomical Observatory
OGO	Orbiting Geophysical Observatory
OSO	Orbiting Solar Observatory
OWS	Operational Weather Support
RAE	Radio Astronomy Explorer
RCS	Reaction Control System
RIC	Rockwell International Corp.
SAMSO	Space and Missile Systems Organization
SMS	Synchronous Meteorological Satellite
TIP	Transit Improvement
TOPS	Thermoelectric Outer Planet Spacecraft
USAF	United States Air Force
USN	United States Navy
VO '75	Voyager - 1975 Mission

6.3 Vendor Directory

AIRCRAFT POROUS MEDIA
Pall Corporation
30 Sea Cliff Avenue
Glen Cove, New York 11542
R. Mahon, 516/671-4000

ALLEN DESIGN, INC.
108 Graham Place
Burbank, California 95102
R. B. Wagner, 213/842-6128

AMETEK
Calmec Division
8401 East Slauson Ave.
Pico Rivers, California 90660
S. Lombardo, 213/723-8581

BELL AEROSYSTEMS COMPANY
P.O. Box 1
Buffalo, New York 14240
M. J. O'Connell, 716/297-1000

BOURNS, INC.
Instrument Division
6135 Magnolia Avenue
Riverside, California 92506
Mr. Ogle, 714/684-1700

BRUNSWICK CORPORATION
Wintec Division
5223 W. Imperial Highway
Los Angeles, California 90045
J. R. Baker, 213/641-4300

CIRCLE SEAL CORPORATION
James, Pond & Clark Div.
P.O. Box 3666
1111 North Brookhurst
Anaheim, California 92803
J. W. Tarter, 714/774-6110

COLT INDUSTRIES
Chandler Evans, Inc.
Control Systems Division
Charter Oak Boulevard
West Hartford, Connecticut 06101
D. E. LaPorte, 203/236-0651

6.3 Vendor Directory (cont'd)

CONSOLIDATED CONTROLS CORPORATION
2338 Alaska Avenue
El Segundo, California 90245
H. A. Waller, 213/772-5301

ECKEL VALVE COMPANY
1425 First Street
San Fernando, California 91340
F. G. Space, 213/361-6251

FIRCHILD INDUSTRIES
Stratos Division
1800 Rosecrans Avenue
Manhattan Beach, California 90266
A. M. Tierney, 210/623-9111

GOULD, INC.
Statham Instruments Division
2230 Statham Bldv.
Oxnard, California 93030
H. Stonelake, 805/487-8511

HAMILTON STANDARD
United Aircraft Corporation
Windsor Locks, Connecticut 06101
R. W. Sievers, 203/623-1621

HTL INDUSTRIES
373 S. Fair Oaks
Pasadena, California 91105
E. Rector, 213/792-7131

HUGHES AIRCRAFT
P.O. Box 92919
Airport Station
Los Angeles, California 90009
D. B. Frizell, 213/648-8626

MAROTTA SCIENTIFIC CONTROLS
P.O. Box 330
1500 Boonton Avenue
Boonton, New Jersey 07005
J. F. Unger, Jr., 201/334-7800

MOOG, INC.
Proner Airport
East Aurora, New York 14052
D. C. Loudon, 716/652-2000

6.3 Vendor Directory (cont'd)

PYRONETICS

10025 Shoemaker
Santa Fe Springs, California 90670
F. E. Maggiore, 213/941-0237

RCA ASTRO ELECTRONICS

P.O. Box 800
Princeton, New Jersey 08540
D. L. Balzer, 609/448-3400

ROCKER INDUSTRIES

1500 West 240th Street
Harbor City, California 90710
W. Glen, 213/534-5660

ROCKET RESEARCH CORPORATION

York Center
Redmond, Washington 98052
J. J. Galbreath, 206/885-5000

ROSEMOUNT, INC.

12001 West 78th Street
Eden Prairie, Minnesota 55343
M. Shedlov, 612/941-5560

SIEBELAIR CORPORATION

5563 West Washington Boulevard
Los Angeles, California 90016
J. E. Siebel, 213/939-2183

STERER ENGINEERING & MANUFACTURING CO.

Box 39787
4690 Colorado Blvd.
Los Angeles, California 90039
J. W. Pauly, 213/245-7161

TAVCO, INC.

20500 Prairie Street
Chatsworth, California 91311
W. Ellwood Jae, 213/882-5411

TAYCO, INC.

441 East 4th Street
Long Beach, California 90812
C. H. Taylor, 213/437-0387

6.3 Vendor Directory (cont'd)

TRW INC.
Systems Group
One Space Park
Redondo Beach, California 90278
B. W. Davis, 213/535-4321

VACCO INDUSTRIES
10350 Vacco Street
South El Monte, California 91733
A. Keskinen, 213/443-7121

VALCOR ENGINEERING CORP.
365 Carnegie Ave.
Kenilworth, New Jersey 07033
L. M. Anderson, 201/245-1665

WHITTAKER CORPORATION
Controls Division
12838 Saticoy Street
North Hollywood, California 91605
R. A. Katz, 213/765-8160

WRIGHT COMPONENTS, INC.
Industrial Products Div.
Broad and South Streets
Clifton Springs, New York 14432
J. F. Hitt, 315/462-2010

6.4 References

This section provides two lists of bibliographic information concerning the reference numbers cited on the data sheets in Section 4.2. The first list (6.4.1) is arranged in ascending accession number order. The second list (6.4.2) provides identical information arranged alphabetically by corporate author name and numerically by accession number within corporate author.

6.4.1 References in Accession Number Order

- 1 Holcomb, L. B. (Jet Propulsion Laboratory, Pasadena, CA) and Lee, D. H. (TRW Systems Group, Redondo Beach, CA). Survey of Auxiliary-Propulsion Systems for Communications Satellites. AIAA Paper No. 72-515, 24 pp., Apr. 24-26, 1972
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- 4 Kelley, J. H. (Jet Propulsion Laboratory, Pasadena, CA). Low Cost Attitude Control Propulsion. 10 pp.
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- 7 Park, L. T., Corbin, J. D., and Ernst, R. D., (Martin Marietta Corp., Denver, Colorado). Titan Transtage Spacecraft Propulsion System. AIAA Paper No. 73-1210, 21 pp., Nov. 5-7, 1973
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- 9 Russi, M. J. (The Aerospace Corporation, El Segundo, CA). A Survey of Monopropellant Hydrazine Thruster Technology. AIAA Paper No. 73-1263, 14 pp., Nov. 5-7, 1973
- 11 Sutton, D. (Rocket Propulsion Establishment, Westcott, Nr. Aylesbury, Bucks, England). Hydrazine Thrusters for Space Application. Journal of the British Interplanetary Society, Vol. 25, pp. 537-551, 1972
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- 13 Anon. (Government Data Publications, Washington, D. C.). Air Systems Encyclopedia. 1974
- 14 Kelley, J. H. (NASA). Attitude Control Propulsion Working Panel. Dec. 1, 1972
- 15 Holcomb, L. B. (Jet Propulsion Laboratory, Pasadena, CA). Satellite Auxiliary-Propulsion Selection Techniques. Technical Rept. 32-1505, 131 pp., Nov. 1, 1970
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